

10,000-Mile Test of Ford's New In-Between Car

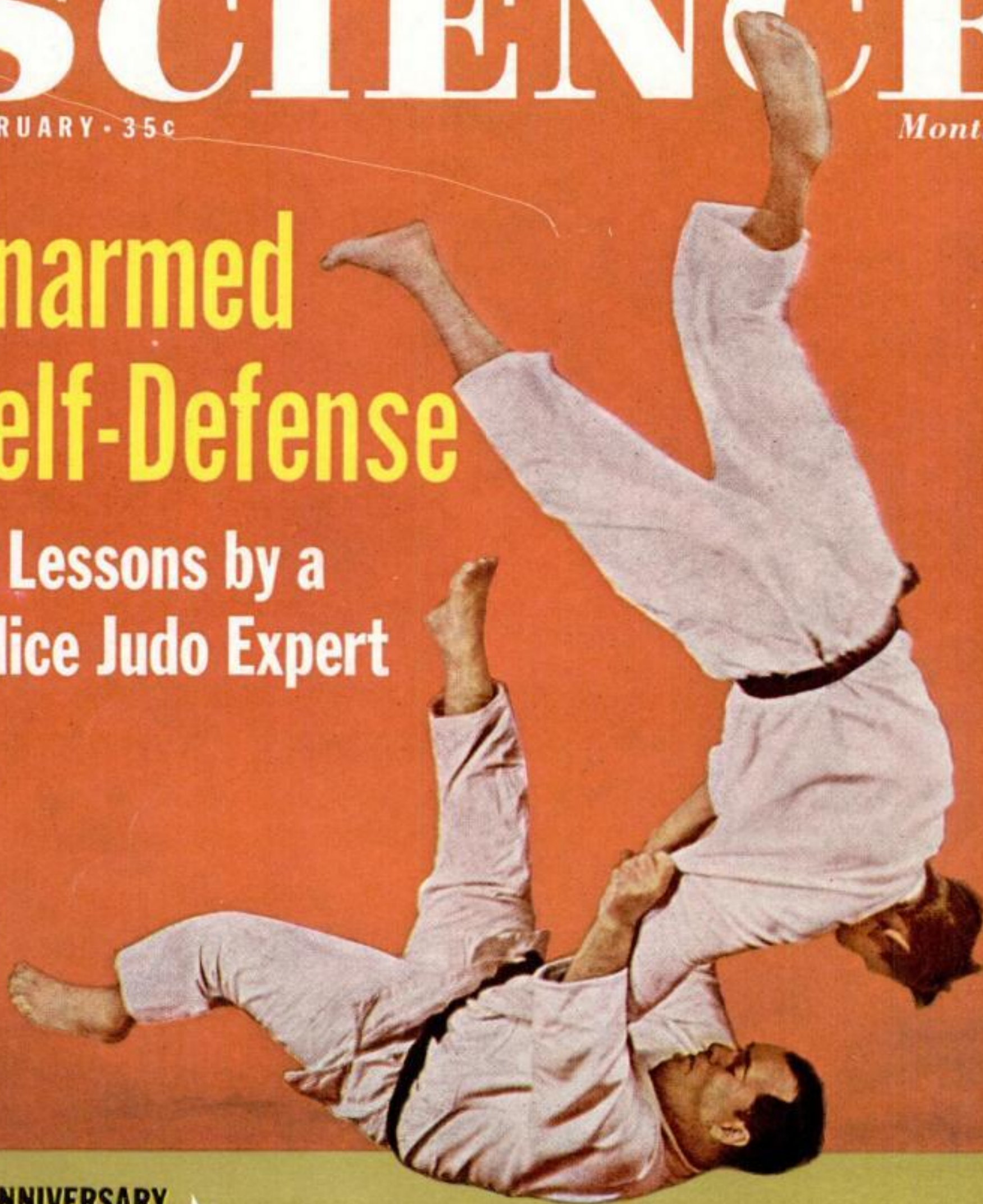
POPULAR SCIENCE

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Monthly

Unarmed Self-Defense

12 Lessons by a
Police Judo Expert



90th ANNIVERSARY
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FEATURE**

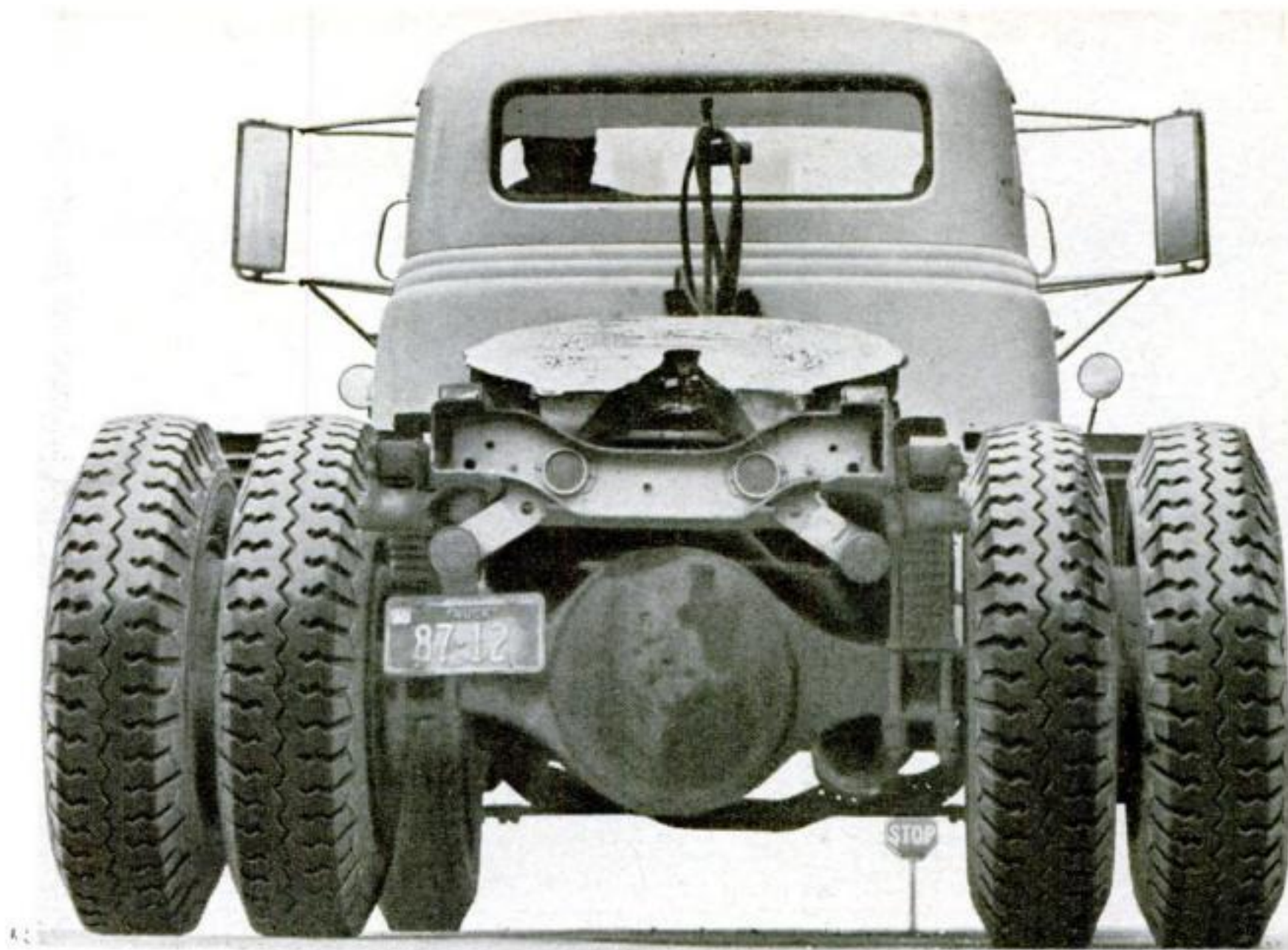
28 PAGES on Home Electronics

KITS • STEREO • CAR FM • COLOR TV • GARAGE-DOOR OPENER

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cigarettes
used to taste?
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still do**



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I'M READY NOW, MR. WALSH

THEY GAVE ME SOME SIMPLE ASSIGNMENTS... AND I SURE SURPRISED THEM!

SAY, WHERE DID YOU LEARN ABOUT PUMPS?

SAME PLACE YOU DID, JOE... I.C.S.

THEN A FEW DAYS LATER, MR. WALSH CALLED ME IN...

JIM, I'M KEEPING YOU HERE AND PUTTING YOU ON SALARY. YOU'LL BE GETTING ABOUT \$20 MORE A WEEK. AND AT THE RATE YOU'RE GOING, I EXPECT I'LL HAVE TO RAISE THAT IN SIX MONTHS

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OH, JIM! IT'S A DREAM HOUSE!

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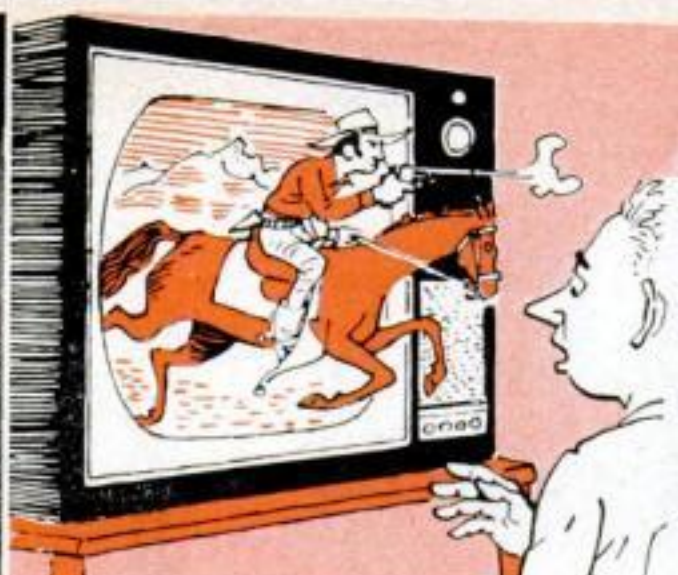
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Popular Science ®

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February, 1962

Cover photo by W. W. Morris

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**NEXT
MONTH**

PS takes to the water, with a big 90th-anniversary boating issue: news, views, and how-to-do-it. Dive in!

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PS Readers

TALK BACK



'Mystery' Speaker Box Gets Nod

I'VE just built the Jabez Gough speaker enclosure ["Miracle Hi-Fi Speaker?" Nov., p. 168]. Plain curiosity caused me to do so. I'm familiar with audio reproduction systems and I just couldn't see how it could possibly work.

Imagine my surprise when amazingly clear and beautiful sound poured forth after I connected the enclosure to my *six-transistor pocket radio*! Later experiments with records and FM tuners proved this to be the most rewarding project I have ever assembled. The enclosure reproduces as well as any under \$200 that I have heard.

I assembled the unit in two evenings, using $\frac{3}{8}$ -inch plywood for the entire cabinet. My speaker is a \$1.98 American-made six-inch round type. A fiber-glass lining on the inner chamber walls tended to put more "heft" in midrange. The cabinet resonates at all frequencies. A few simple tests I have run fail to show any appreciable peaks.

JOHN OCCHUIZZO, Greensburg, Pa.

... I HAD a 12-inch commercial speaker and it seemed all right to me until I made your hi-fi speaker. Although not a miracle, it is very good. My wife was so pleased with the tryout that she hasn't let me veneer it yet.

I used a Wolverine eight-inch speaker and a model E.A.2 amplifier. The old 12-incher is for sale now!

E. CHAPMAN, Toronto, Ont.

... FOR anyone who wants good stereo fairly cheap, Gough's is the perfect idea. I made two "miracle-speaker" enclosures for my portable stereophonic record player. I removed the four speakers from the chassis of the main case and the top and fitted them side by side in the new cabinets. The cabinets were expanded in width to take the paired three- and six-inch speakers.

"Boxiness" is not too audible and the sound is terrific. I'd been having trouble with harshness when instruments of high fre-

quency played, and the bass wasn't full enough. Now, reproduction is complete.

I have compared the sound with a \$400 set and there's very little difference, possibly because my cabinets are set nearly 10 feet apart instead of closely packed in one enclosure. The setup cost me \$118 in all—\$100 for the portable set and \$9 each for the cabinets built from your design.

J. A. COLLETTE, Kingston, Ont.

Needling the Railroaders

I ENJOYED "Record-Breaking Ride on a Super-Freight" [Nov., p. 91]. It shows what the railroads could have accomplished years ago if they'd concentrated on eliminating deadwood and sleepy old methods instead of sitting on their hands and hollering "subsidies" at the truckers, airlines, and shiplines.

But there's still progress to be made. What possible justification can there be for stopping a train nine times in 32 hours for as many crew and crew-car changes?

JOHN RIDER, Sauquoit, N. Y.

Aloha and Okolehao

THAT apple squeezer ["How I Rebuilt a Cider Press," Nov., p. 158] ought to come over here. Last summer I was invited to my first Hawaiian luau and was a little skeptical before I arrived where the pig was roasting in the ground.

I was all set to claim that I was not able to eat or drink any weird native concoctions because of my ulcer, when my host offered



me tea. I gladly accepted and enjoyed it so much I asked what kind of tea it was. He told me it was 86-proof ti from the ti plant (pronounced tea), mixed with iced tea.

Since then, I've tried it in water, soda, and ginger ale, and no matter how much

[Continued on page 10]

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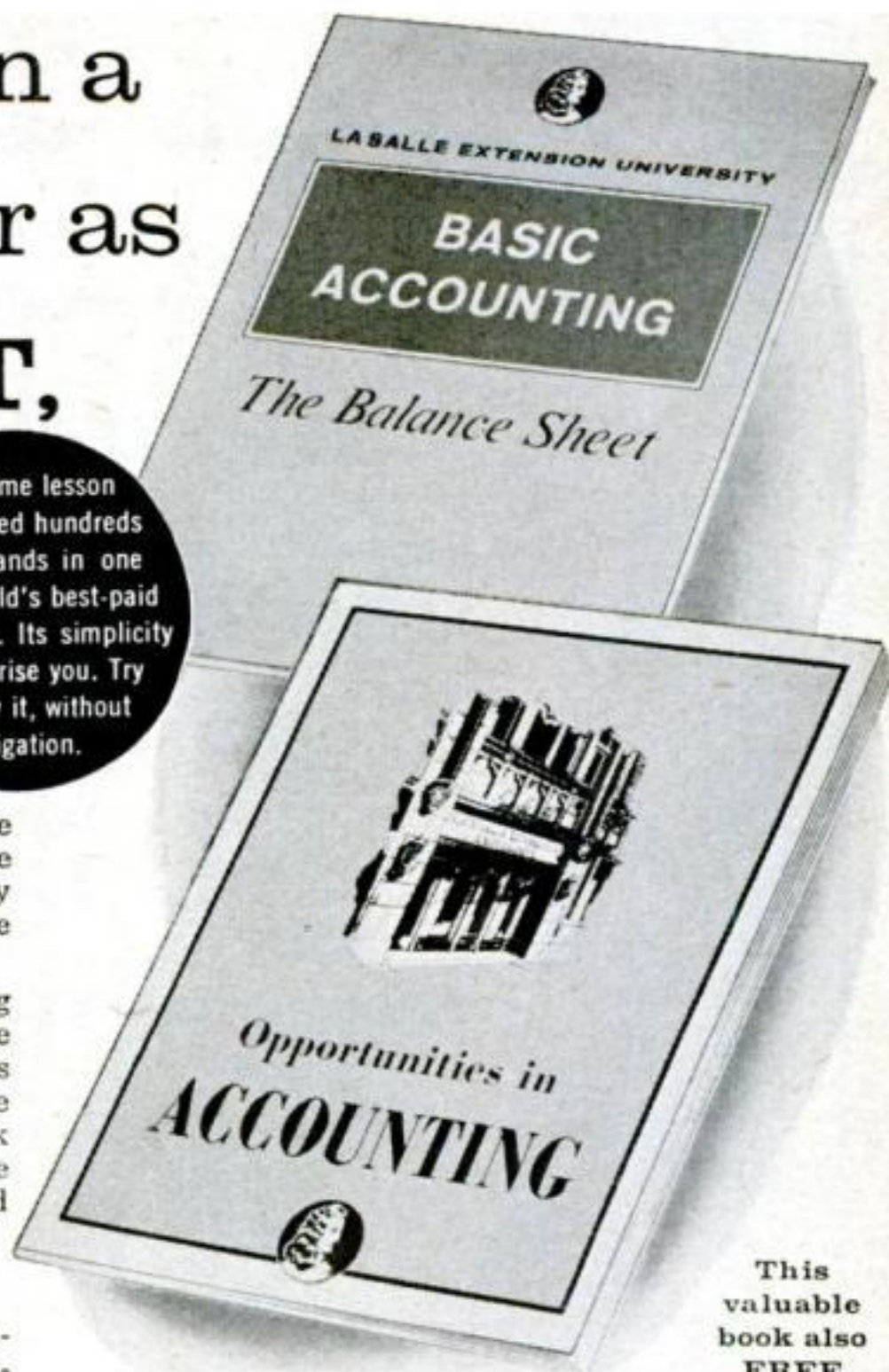
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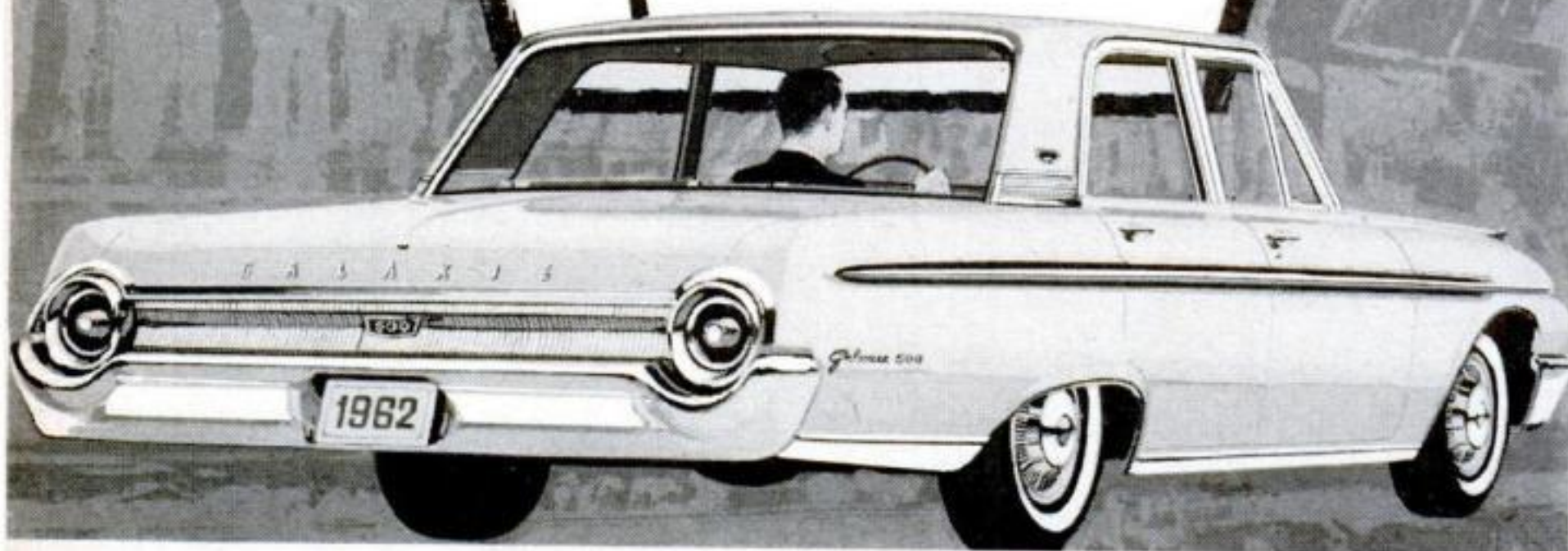
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Now
you'll have to
listen 17% harder
to hear a
Galaxie
whisper



Its silence whispers quality . . . for there is no surer proof of the care with which a car is built than the quiet with which it runs. A decibel meter in the

front seat revealed a 1962 Galaxie is 17% quieter than last year; the built-in protection of twice-a-year—or 6,000 mile—maintenance insures it will *stay* quiet.

How did America's quiet car get even quieter? It took a "tuned" frame, a nylon dot, a fiber sandwich—and new advances in Ford's new science of *automatic* quality.

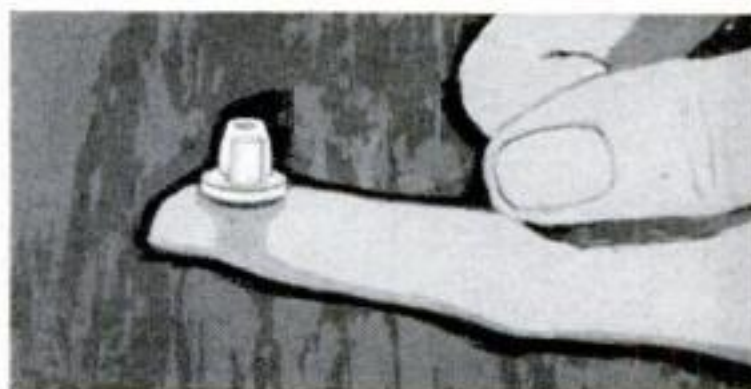
It is perfectly true that last year's Galaxie was so astonishingly quiet it made the \$10,000 cars of only a few years ago seem crude by comparison. But it also is perfectly true that *this* year's Galaxie is substantially quieter . . . 17% quieter in the front seat, 21% quieter in the rear seat.

No one big invention made the difference. These cars move like a silk banner in a summer breeze because hundreds of little things were improved, because Ford's quality control is now the highest in the industry . . . and because Ford has made silence *automatic* by ingenious design techniques.

A tiny blob of nylon is one example of this new approach. You see it illustrated on the finger at right: a "sleeve nut" that connects a rod and lever in the door latch. In 1961 this connection was made by a metal spring clip; no matter how carefully made or fitted there was always the possibility of wear . . . and a faint little vibration. Now the rod snaps into a hole in the soft nylon nut, the nylon snaps into the lever . . . and

there is no possibility of metal-to-metal contact.

We also have taken one of the largest things in a Galaxie, the frame, and "tuned" it by designing in a minute degree of flex. Thus it becomes a giant spring, over 16 feet long, that blots up road noises that get past tires, springs and shock absorbers.



New nylon "nut" helps soundproof doors.

The "fiber sandwich" is a ½-inch thick batt of textile fibers that runs from the top of the toe board on down under the front seat. When you realize this is sandwiched between a double-ply layer of waffle felt deadener *and* a thick jute blanket *and* covered by the floor mat you stop wondering why any Galaxie engine is so hard to hear.

These are merely three examples from thousands, all devoted to the single aim of making a Galaxie quiet. It would take a library to tell the whole story, to even begin to sum up Ford's standards of craftsmanship . . . but the *result* is beautifully, silently obvious the moment you take the wheel.



Galaxie by Ford

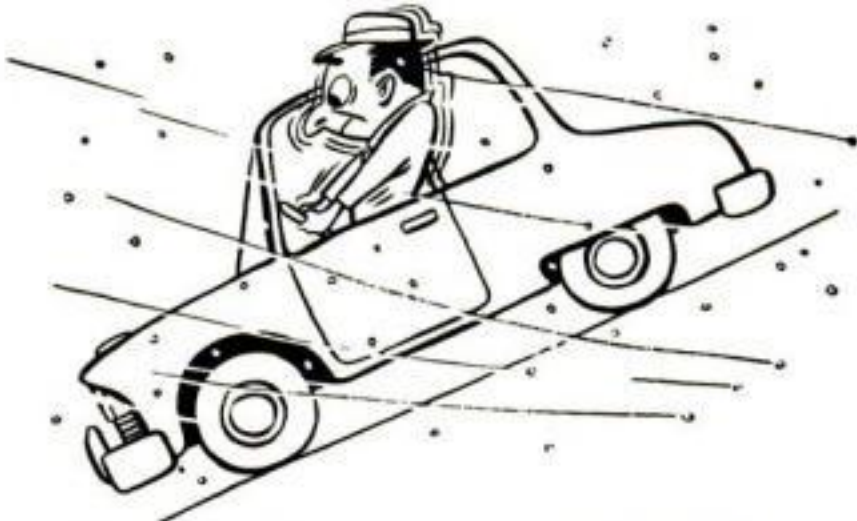
[Continued from page 6]

you drink okolehao, as it is called, you can't get a hangover from it. Cider, indeed!

BILL WALSH, Honolulu.

Proving It the Hard Way

THE pulse brake that fights skids ["New Ideas from the Inventors," Nov., p. 99] reminds me of an icy day when I made a turn down a 17-percent grade. As I applied the foot brake, I started to skid. When I let up on the brake, I kept rolling downhill. To scrape along the sidewalk curb could have thrown me into an end-for-end spin. And at



the bottom of the hill five-o'clock traffic was rolling in both directions.

I got so scared in anticipation of the imminent bangup, that I just simply shook. My foot on the brake pedal shook, too. Believe it

or not, I came to the nicest stop on that slippery hill that you could imagine. From that experience I can testify that a rapid pulse brake application might mean real safety.

A. A. JAGIELLOWICZ, Ansonia, Conn.

The Safety Debate

I'D LIKE to see Detroit iron corner as well as "the MG and some of the other knob-encrusted imports" ["Safety Expert Rates the 1962 Cars," Nov., p. 80].

The Jaguar XK-E had the twin master cylinder long before the Cadillac and American Motors cars, meters rather than idiot lights, and all switches in a central location where nobody can run into them. It has better brakes than Detroit cars, too.

SHELDON WOLFE, St. Paul.

... IN THE Detroit answer "Why We Do Make Cars Safe" [Oct., p. 90] one company man claims among later advances "increased visibility through larger window areas." We don't need more glass. What we need are hoods that don't block your road vision.

DENNIS MCGUCKIAN, Lewiston, Me.

The Ticking Tractor

OTHER tractor owners might benefit from a recent experience of ours so I'll pass it along. We'd been troubled with a tick in the

CONTINUED

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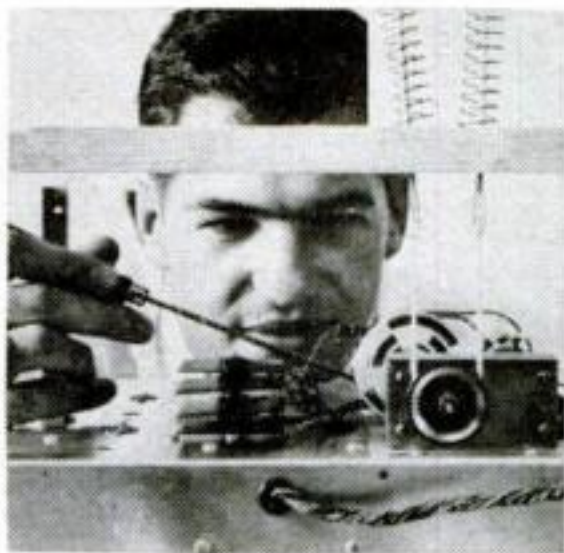
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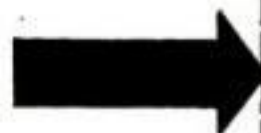
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Dep't A-2 9200 Access Road, Minneapolis 20, Minn.

motor of our farm tractor for some time. We took it downtown to work on it in a garage, where they had the proper tools, and replaced a worn distributor shaft and worn oil-pump gears.

This didn't silence the strange tick and a few days later we took the tractor back to town. After much searching, we finally found the trouble: A cylinder sleeve had loosened somehow and was riding up and down a few thousandths of an inch, causing our mysterious tick.

GLEN CHRISTEN, Elgin, Iowa.

How's Your Putting Eye?

LAST summer [June, p. 57] you ran a picture showing Putter Pool, a new game seen at hotels and motels in the Southwest. Although the game was invented and designed by Tom Tarbox, we hold the manufacturing and marketing rights. Some readers might



like to know there is now a Putter Pool Jr. for home use, indoors or outdoors. It measures four by nine feet.

JIM-LEE Co., Russells Point, Ohio.

Yes Sir, We Agree

YOUR advice on how to save gasoline in hilly country ["Instant Fuel Meter Helps You Stretch Gas," Nov., p. 72] is not to press the gas pedal to maintain speed uphill, but rather to let the car slow up until the crest is reached, then gain speed as the car descends.

What a crazy way to drive and invite disaster! All following cars will bunch up behind you and may even be tempted to pass—on a hill. You'll probably exceed the speed limit going down, just when the following cars want to pass such an erratic driver.

All this, of course, will decrease the maximum capacity of the highway, which is attained when all traffic moves at an even pace. From a safety standpoint—in terms of stopping distance—speed should be greater uphill, slower downhill. I say safety first, economy second.

GRANGER DAVENPORT, Montclair, N.J.

Maintaining even speed is precisely what we suggest. The article states: "I had an un-

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conscious tendency, I learned, to accelerate slightly going up hills." There is no suggestion to lower speed.

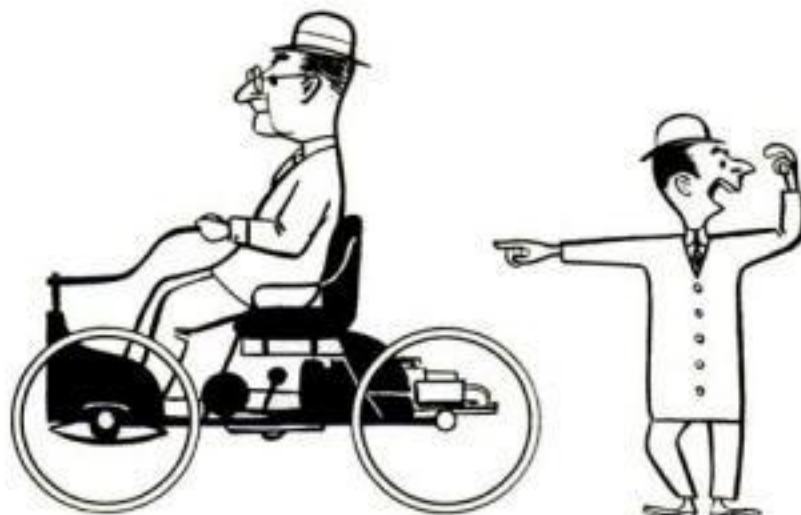
That 1,500-M.P.H. Family Car

I FLEW one of Dr. Bertelsen's aeromobiles last summer at fairs throughout the U.S. I'm afraid Raymond Spencer ["PS Readers Talk Back," Nov., p. 6] is disagreeing with something he doesn't fully understand.

The latest aeromobile attains a forward speed of 70 m.p.h. with a 150-hp. motor. The loss of the cushion of air from the high speed is compensated for by the car's improved surface design. The forward motion creates a lifting action, as air flow over the wings of an airplane does.

The GEM would not plow into the earth if the motor quit at 150 m.p.h. The lift would keep the car in the air until it had slowed to 50. I've landed at this speed many times and not found it unpleasant. Cross-country GEMs probably would have jet engines. A reverse thrust of a jet blast could stop a GEM fast.

The changing of lanes on roadways built for GEMs will be controlled by TV and radar. As for the roads themselves—remem-



ber how people laughed at the first horseless carriages because there were no roads to drive them on?

WARREN H. ANNIS, Ottawa, Ill.

How to Store a Torch

ABOUT that tin-can holder for storing a propane torch ["Shop Tips from PS Readers," Nov., p. 163]: The picture shows the torch stored with the burner attached. This is a good way to lose gas via seepage through the valve. The burner should be removed when the tank is stored.

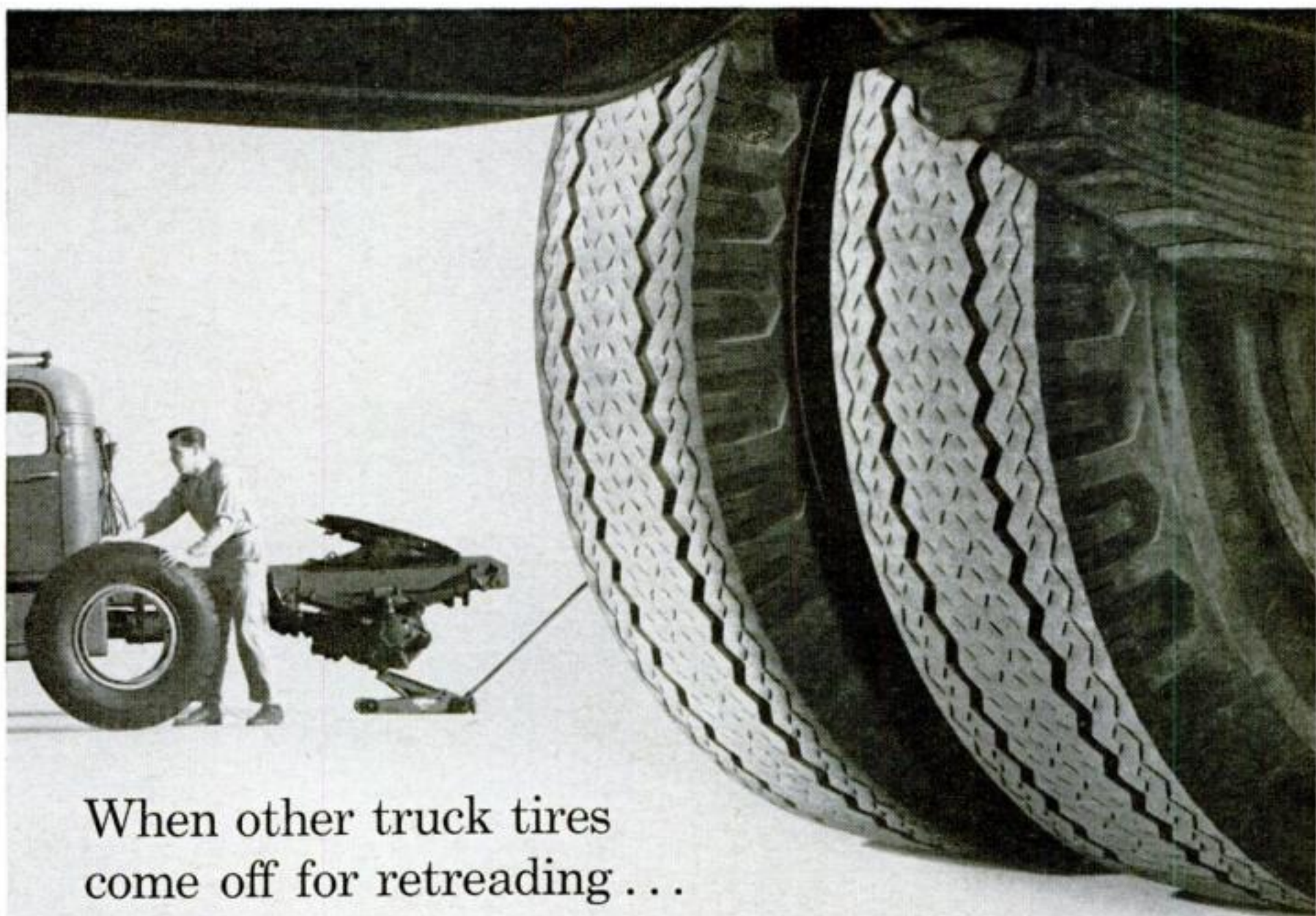
R. W. GRAY, Whippany, N. J.

Eddy Currents Stir Up a Storm

IT SEEMS highly probable that the 200-m.p.h. train with the straight-line electric motor [Nov., p. 76] will work, but not with an aluminum armature.

You mention that among working models of machines using direct straight-line motion,

CONTINUED



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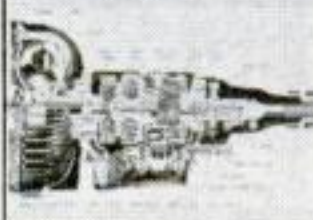
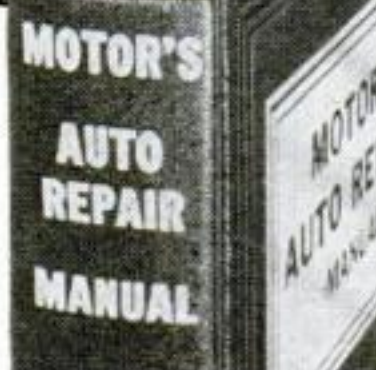
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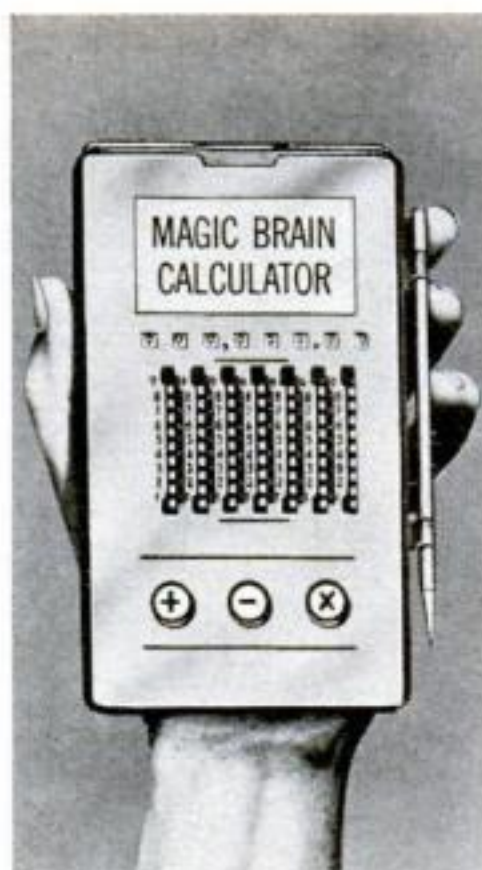
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built by the inventor, is a copper-mesh conveyor belt. This bucks theory all the way.

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M. R. YEISLEY, Sacramento.

The linear motor and similar devices will work ONLY with armatures of nonmagnetic metals that are good conductors of electricity. With iron armatures there'd be no net force developed in the direction to produce forward motion.

The varying electromagnetic field produced by AC in the field coils induces circulating electric currents (eddy currents) in the non-magnetic armature. The effect is the same as in a transformer with ends of the secondary winding shorted together. The propulsive force is the result of the interaction of the magnetic field due to the eddy currents and the magnetic field from the field coils.

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WE MAKE a fruit picker that will do what Mr. Burzdak ["I'd Like to See Them Make," Oct., p. 104] has in mind. In fact, it will do more. There is no need for a ladder and "interfruit" bruising—a problem with his fruit-picker's bag—is eliminated.

Our tool operates like a picker's hand, grasping and pulling the fruit from the twig. Very little grasping pressure is needed because the moving flap door of the picking



head pushes fruit into the "hood," which acts as a pocket to pull the fruit gently from the tree. By slightly restricting the looseness of the plastic sock, drag is produced to slow or stop the fruit as it reaches previously picked fruit at the lower end.

CHELANE OF ARCADIA,
230 N. Walnut, Arcadia, Calif.

Figuring Machine Screws

ONE of your short cuts and tips [Nov., p. 143] states that a 1/8-inch cotter pin takes a

CONTINUED

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perfect 8-32 thread. The major diameter of an 8-32 is .164 inch. A 5-40 die would be fine since the major diameter of a #5 screw is .125 or $\frac{1}{8}$ inch.

Beginning with an 0-80, which is .060 inch, add .013 inch for each additional number and you have the major diameter of numbered machine screws. Commercial screws run from .002 inch to .005 inch below the major diameter; wood screws a bit more.

J. CHRENKO, Newark, N.J.

Making a Floating Whatzit

LAST year I built a boat out of some three-by-ones, eight shelf brackets, and two old inner tubes. The craft, built for my 10-year-old son, is unsinkable and won't readily capsize.

The bottom slats (not seen in the photo) are slightly longer than the top ones. The bottom ends of the brackets are bent at right angles and the bottom slats are secured to them by bolts and wingnuts. The



top slats are fastened securely by screws.

A paddle could be made from a length of $1\frac{1}{4}$ -inch round with a pair of gallon paint-can lids fixed at each end.

KEN JAMIESON, Wanganui, N.Z.

The Window-Shade Warmup

MR. BERG-HANSEN of Norway surprised me with his description of a window-shade-and-pulley hookup for car radiators ["PS Readers Talk Back," Nov., p. 20]. For a man living so close to Sweden, he is strangely unfamiliar with Swedish cars.

Both the SAAB and the Volvo have had radiator blinds for many years. I've owned three different Volvo models and now own a SAAB Gran Turismo 750 and I've had little trouble with fan suction bothering shade operation. On the occasions when car speed caused too much air pressure plus fan action, easing up on the gas freed the shade.

CAPT. RICHARD STOVER, Otis AFB, Mass.

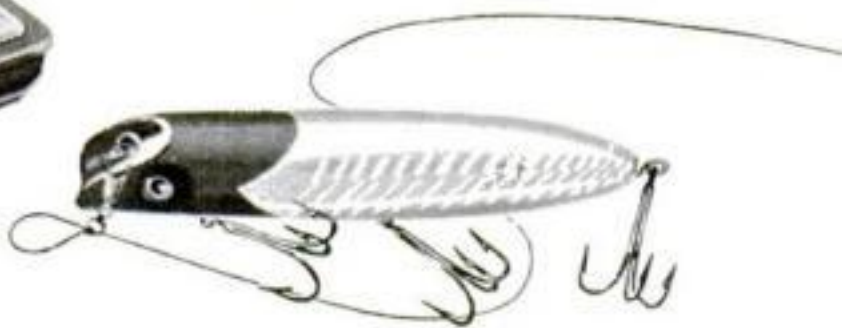
... I TRIED the window-shade warmup as originally described in PS [Nov. '60, p. 193] with the roller at bottom of the radiator, but I soldered the slot ends closed so the roller wouldn't slip forward or out of the brackets. The roller is inserted by springing the clips.

It worked fine except at high speed (as

CONTINUED



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☐ Please send me the Hi-Fi demonstration record. I enclose \$2 which is refundable when I order my first kit.

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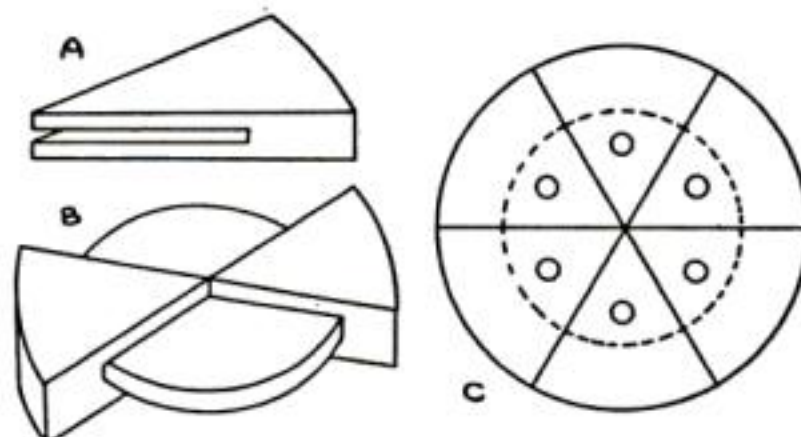
City.....Zone...State.....

Mr. Berg-Hansen suggests) when the shade failed to raise or lower. But my remedy differed. I used paraffin on the radiator front and on the radiator side of the shade. It then slid easily at any speed.

VINCENT THOMS, Portland, Ore.

Making Any Wooden Gears?

"MAKE Wooden Gears" [Nov., p. 144] was a real honey on a much-needed subject. But Mr. Love's gears can be made even better, quicker, and stronger following my sketches.



If a kerf is cut in the leaves of the gear wheel (A) and the leaves assembled around a spline (B), a better wheel will result:

1) There is more glued surface in proportion to the load, so the wheel will be stronger.

2) Because the spline holds the wheel in alignment, it will be easier to hold while gluing.

3) If the finished product is pinned as shown (C), even more strength will be added and it will continue to be of service even if one of the leaves should come unglued.

A. L. HARE, Newtonville, Mass.

More Memory Short Cuts

THE November booklet ["Math and Memory Short Cuts"] is great. The field of short cuts in numbers is infinite and I'll be glad to add these to my collection.

To convert miles per hour to feet per second or yards per second, I have a trick formula. I convert to feet per second using the method in the booklet— $3 \text{ (m.p.h.} \div 2)$ —but deduct $1/30$ of the miles per hour. Thus at 60 m.p.h., the equation would be:

$$\frac{3(60)}{2} - \frac{60}{30} = 88$$

The yards per second, of course, would be $1/3$ of 88, or $29\frac{1}{3}$ yards. Your approximation is near enough for most purposes, and represents the small difference between $1/2$ and $22/45$.

JAMES S. REID, New Milford, N.J.

... YOUR short cut for squaring numbers ending with 5 reminded me of this system for squaring any number:

Take 16, for instance: Add enough to make the number end in zero ($16 + 4$). Subtract a like amount from the number you

CONTINUED

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want to square (16 — 4). Multiply the products (12 × 20). Add to this the square of the number added in the first step (4²). Your answer is 256.

A. L. HARRIS, Drayton Plains, Mich.

... To ESTIMATE the number of cement blocks needed for a job, I figure like this:

Feet in length minus 1/4 gives number of



blocks. Feet in height plus 1/2 gives number of rows high. Example:

$$\begin{array}{rcl} 16 \text{ ft.} - \frac{1}{4} & = & 12 \text{ blocks} \\ 8 \text{ ft.} + \frac{1}{2} & = & 12 \text{ rows} \end{array}$$

144 blocks needed

For a foundation, add the two dimensions plus 1/2, and subtract 2. Corner blocks measure 24 inches (16 inches on one wall, 8 inches on the other). Example for a foundation 20 by 30 feet: 20 + 30 = 50 + 1/2 = 75, less 2 = 73 blocks to one row.

I worked this out in 1914 and have not found it off in all this time.

JOHN J. HORAN, St. Louis

... SINCE you didn't dip into trigonometry, I'd like to share a short cut for remembering the functions of the common angles.

ANGLES

	0°	30°	45°	60°	90°
SINE	0	.5	.707	.866	1
OR:	1/2√0	1/2√1	1/2√2	1/2√3	1/2√4

These were always confused in my mind—especially when not used frequently—until I remembered to think of them in sequence as shown above.

W. A. ERLEY, Chicago.

... THE hint about Chief SOH-CAH-TOA on the cover of your booklet brought to my mind another, and perhaps more efficient, method for remembering the trigonometric functions. I think of the phrase, "Saddle Our Horses, Canter Away Happily, To Other Adventures." The initials are taken



Here are *3 good reasons*

why I'm glad

I became a **DURACLEAN DEALER**

Raising a family takes a dependable, steady income. Too few jobs offer security and chance for advancement. That's why so many men are going into a business of their own. All around us are local merchants making a good living in respectable businesses where they hold a franchise. The big questions are "What is left to go into?—Which business is profitable?—Which requires only a modest investment?" Many have found the answers in DURACLEAN.

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Duraclean is a scientific method of cleaning carpeting and upholstery in the home. This better process of cleaning by absorption virtually "lifts" the dirt from fabrics, leaves them bright and lively. Almost every home, hotel and many offices are potential customers who will call you again and again.

Check Experience of Other Dealers

There's no better way to learn of DURACLEAN profit opportunities than by checking with dealers already in business. If there's one near you, call him—or ask DURACLEAN whom to call.

M. LYONS: ILLINOIS

"Averaged over \$50,000 my first 3 yrs. Headquarters' help makes it possible".

C. RANDALL: OHIO

"My 2nd year and business keeps growing. Have made as much as \$120 in one day".

E. BAILEY: ARKANSAS

"I know of no other business which can offer so much".

L. LAWSON: NEW YORK

"National advertising creates leads. One month, jobs totaled \$1475".

DURACLEAN COMPANY

2-182 DURACLEAN BLDG., DEERFIELD, ILLINOIS

DURACLEAN PROVIDES EVERY BUSINESS BUILDING NEED

DURACLEAN headquarters supplies all equipment and chemicals to put you in business. Regularly held training sessions, cover techniques, methods and means of developing business. Local advertising helps and merchandising ideas are available; and an impressive national advertising program pre-sells customers on the gentle DURACLEAN cleaning process.

Start part time, full time or hire others. **NO SHOP NEEDED.** DURACLEAN service is rendered in the home or customer's place of business. Just 2 average jobs a day can net \$8,750.00 a year.

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5 other DURACLEAN services multiply your profits. DURASHIELD soil retarding service, DURAPROOF mothproofing and DURAGUARD flame retarding are among the other services that mean more money for you. It takes less money to establish this prosperous business. No wonder so many men with vision are becoming DURACLEAN DEALERS. Why don't you? Write today for FREE booklets.

MAIL THIS "FUTURE SECURITY" COUPON

DURACLEAN COMPANY

2-182 Duraclean Bldg., Deerfield, Illinois.

Rush me all the facts about DURACLEAN PROCESS and what it takes to become a DURACLEAN DEALER.

NAME _____

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CITY _____ STATE _____

from the three places in each of the three functions:

$$\text{Sine} = \frac{\text{Opposite}}{\text{Hypotenuse}} \quad \text{Cosine} = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\text{Tangent} = \frac{\text{Opposite}}{\text{Adjacent}}$$

This simple memory aid may help other readers.

ALAN MILLER, Cedarhurst, N.Y.

... I LEARNED a few short cuts from your booklet, but I think my method of temperature conversion is simpler than yours. The magic number is 40.

To change Centigrade to Fahrenheit, add 40, multiply by 9, divide by 5, subtract 40.

To change F to C, proceed the same way but multiply by 5/9.

With the system you give, I always had trouble remembering whether to add or subtract the 32, and when.

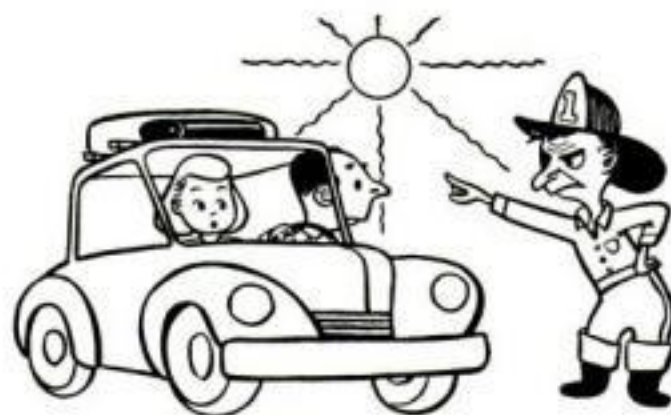
C. L. VAN DA GRIFF, Dallas.

Warning for Gasoline Carriers

THAT "Hint from the Model Garage" showing a can of gasoline strapped to the roof of a car [Nov., p. 190] could destroy hours of fire-prevention work by firemen.

When the can is upright, its cap may be tightened sufficiently to prevent spillage. But

such cans often leak if laid on their sides, especially when pressure builds up due to exposure to the sun. In an accident—imag-



ine a roll-over—gas from the ruptured can would flow over the car until it reached the hot exhaust or a shorted wire.

C. H. JACOBS, Ft. Washington, Pa.

Epoxy and a Prayer?

THIS dodge saved a friend of mine several hundred dollars in a tow bill last week: He was 10 miles off the highway in Baja California, Mex., on a high-crown trail when a rock punched a hole in his automatic-drive transmission case. All the oil leaked out.

It was a long walk out to find a tow so he decided to try and fix it. He jacked the car up and wiped off the gearcase with gasoline. He had his fishing-tackle box with him and

CONTINUED

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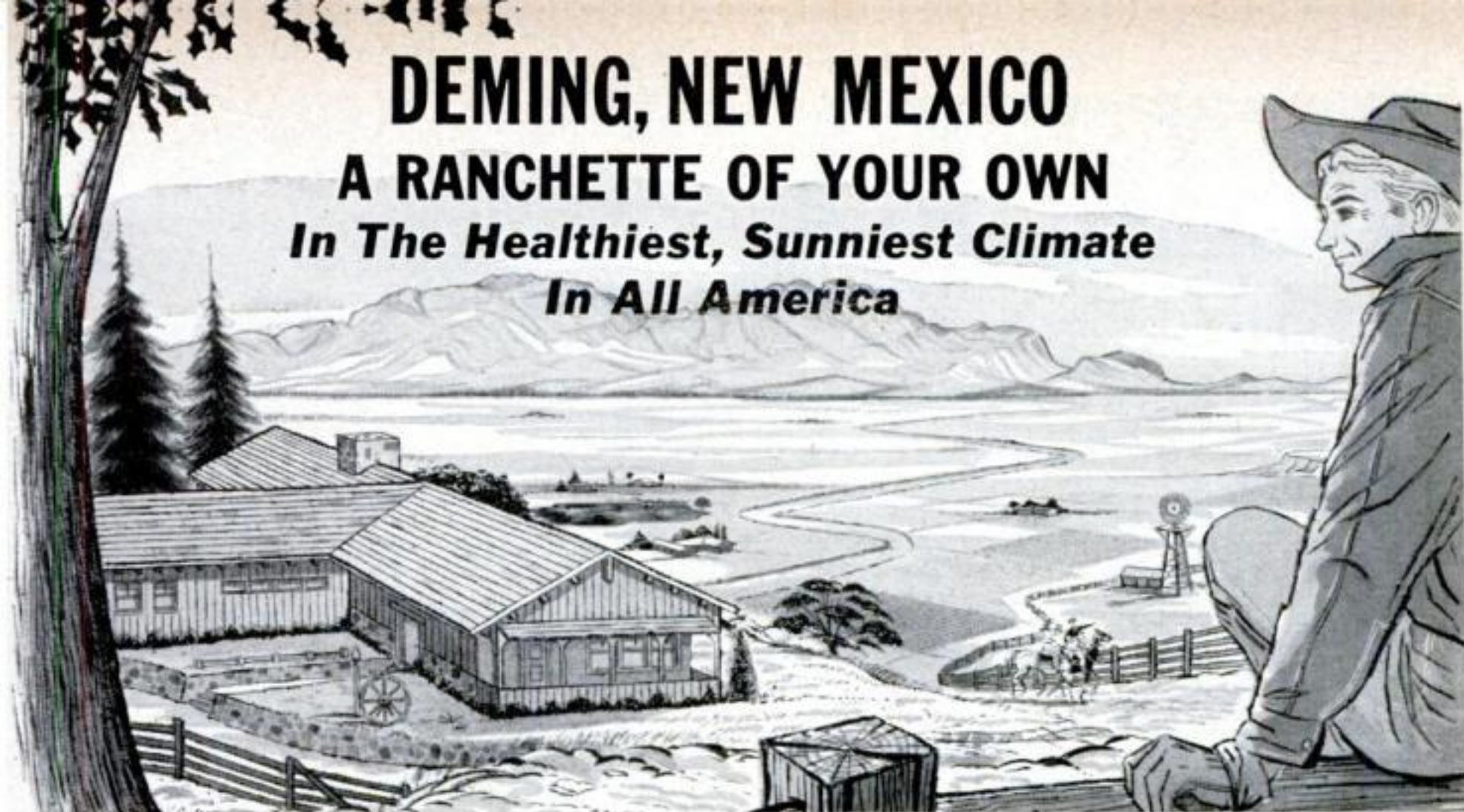
\$2.49
Carburetor
Clean-out kit

\$1.69
Gumout
Pint Can

DEMING, NEW MEXICO

A RANCHETTE OF YOUR OWN

In The Healthiest, Sunniest Climate In All America



\$199 PER HALF ACRE

There is a broad ribbon of highway that begins in the heart of Savannah, Georgia and winds for 3000 miles to its terminus in exciting Los Angeles. This ribbon is mighty Route 80—the most travelled all-weather highway in the U.S. Millions of Americans have followed it to the West, coursing through the rich hills of Georgia and Alabama, passing through the heart of Mississippi and Louisiana and entering into the plains of Texas. Gradually the scenery begins to change. Texas begins to roll; distant hills become higher. Then suddenly one emerges into "The Land of Enchantment." New Mexico's wonders erupt in a blaze of color and majesty. The mighty mountains thrust themselves, tree-topped, into the unimaginable blue of the sky. Dust and smoke have vanished from the air and the lungs drink in great delicious draughts in heady delight. If it is wintertime snow may cap the lofty mountains. If it is spring or summer or fall the unspoiled air touches the skin softly and the feeling of well-being is nowhere else equalled. But winter or summer, it is almost certain the sun will be shining in New Mexico—the sunniest, healthiest state of all 50. Yet great 80 is just beginning to take you through the sunshine wonderland of America. In the tropical southwestern pocket of our country you glide through towns like Las Cruces and Deming. A short while westward and you are in Tucson and Phoenix, Arizona, and from there the West Coast beckons. But nowhere in this enchanting Southwest is there a more beautiful area than the mountain-rimmed, pure-aired New Mexico region of Las Cruces and Deming.

To live anywhere in New Mexico is to live better. The superb climate, naturally air-conditioned in the summer and brilliantly sunny in the winter—the breathtaking beauty of a lavish Nature—the young vigor of a state that is causing an unprecedented business and investment boom—the record which shows that one lives longer, that health improvement is almost miraculous—these are the reasons that tens of thousands of Americans already have come here to live, and hundreds of thousands of others will be following in the immediate years ahead.

Consider then: Here in the center of this miraculous climate and beauty are towns which have grown amazingly in the last 10 years. Las Cruces, for example: In 1950 it had 12,000 people. By 1960, 37,000... a rise of 300% in 10 years! (How about your town? Has it grown 3 times its size in 10 years?) Like Tucson and Phoenix, this area is a beautiful semi-tropical paradise where palm trees and long staple cotton-fields flower the landscape. Statistics show the same 85% of possible sunshine, summer and winter; these same figures reveal even purer, drier air than in Phoenix or Tucson.

A few minutes from the flavorful city of Deming (population 8,000) is a 5,000 acre Ranch, picture-framed by the breathtaking Florida Mountains. So real, so beautiful, so typically the romance of the Southwest is this valley Ranch that it has been photographed for the covers of many magazines including the official publication of the State of New Mexico. What better way to describe its Southwestern flavor than to tell you that when the producers of the movie THE TALL TEXAN sought an authentic locale for their picture, they chose the very land we are now sub-dividing into the DEMING RANCHETTES. THE TALL TEXAN was filmed on our ranch, the same place where you may have a Ranchette of your very own!

This is the lovely basin of land where heavy equipment is now at work constructing wide roads facing every DEMING RANCHETTE. Every Ranchette will have direct access to avenues leading to three major highways surrounding our property—U.S. Highways 80, 70 and State Highway 11.

\$5 DOWN \$5 PER MONTH

DEMING RANCHETTES is blessed with water which is called "America's finest drinking water, 99.99% pure." (Almost every shop in Deming displays this proud claim in its window.) Home building has already begun in DEMING RANCHETTES and electric lines and telephone connections await you. Schools, hospitals, churches, shops, theaters, golf course, tennis courts—these are close by in the charming growing city of Deming. Fertile soil is yours for the planting, and wait until you see the stunning landscape of cotton fields in bloom. Fruit trees... apple, peach, pear and plum... do not grow better anywhere.

And the price of your Ranchette? Just \$199 complete for a half-acre, \$5 down and \$5 monthly. That's the complete price—no extras, no interest, no taxes! At this moment you may reserve as many half-acre sites as you wish but please bear this in mind: DEMING RANCHETTES is not an enormous development and land such as this goes fast. At these prices you may want your Ranchette to be larger—one, two—even five acres. An immediate deposit will guarantee that your half-acres will adjoin each other (this may not be so in the near future). And you take no risk in sending your deposit. Your \$5 per half-acre will definitely reserve your land but does not obligate you. You have the unqualified right to change your mind 30 days after we send you your Purchaser's Agreement, Property Owner's Kit, Maps and Photographs—30 full days to go through the portfolio, check our references, talk it over with the family. If, during that time, you should indeed change your mind your reservation deposit will be instantly refunded. (Deming and Albuquerque Bank references.)

Ten years ago, in nearby Las Cruces, a comparable fertile half-acre such as we offer in DEMING RANCHETTES could have been bought for \$199. Today it's up to \$2000! Experienced realtors predict the same future for Deming—in a much shorter time! If this makes sense to you your next act is mailing the coupon below. And one more thing: we promise that no salesman will annoy you. Thanks, sincerely, for your attention.

DEMING RANCHETTES DEPT. L-5
112 West Pine Street, Deming, New Mexico

Gentlemen: I wish to reserve the following site in Deming Ranchettes:

- ☐ ½ acre for \$199. I enclose \$5 as a deposit.
- ☐ 1 acre for \$395. I enclose \$10 as a deposit.
- ☐ 1½ acres for \$590. I enclose \$15 as a deposit.
- ☐ 2½ acres for \$975. I enclose \$25 as a deposit.
- ☐ 5 acres for \$1925. I enclose \$50 as a deposit.

Please rush complete details, including my Purchaser's Agreement, Property Owner's Kit, Maps, Photographs and all data. It is strictly understood that I may change my mind within 30 days for any reason and that my deposit will be fully and instantly refunded if I do.

NAME.....

ADDRESS.....

CITY.....ZONE.....STATE.....

MEN PAST 40

Afflicted With Bladder Trouble, Pains in Back, Hips, Legs, Nervousness, Tiredness.

If you are a victim of these symptoms, your trouble may be due to Glandular Inflammation. A constitutional Disease that requires special types of medical treatment. Neglect of such Inflammation causes men to grow old prematurely and often leads to Incurable conditions.

Most men, if treatment is taken in time, can be successfully NON-SURGICALLY treated for Glandular Inflammation. If the condition is aggravated by lack of treatment, surgery may be the only chance.

NON-SURGICAL TREATMENTS

The NON-SURGICAL New Type treatments used at the Excelsior Medical Clinic are the result of discoveries in recent years of new techniques and drugs, plus over 20 years research by scientific technologists and doctors.

Men from all walks of life and from over 1,000 communities have been successfully treated here at Excelsior Springs. They found soothing and comforting relief and new health in life.

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When you arrive, our Doctors, who are experienced specialists, make a complete examination. You then decide if you will take the treatments needed, which are so mild, hospitalization is not needed—a considerable saving in expense.

RECTAL-COLON DISORDERS

Are often associated with Glandular Inflammation. These disorders, we can treat at the same time we treat Glandular Inflammation.

REDUCIBLE HERNIA

Is also amenable to a painless Non-Surgical treatment that we have developed. Full details of this treatment given in our Free Book.

Write For FREE BOOK

The Excelsior Medical Clinic has published a New FREE Book that deals with diseases peculiar to men. It could prove of utmost importance to your future life. Write today. No obligation.

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Gentlemen: Kindly send me at once, your New FREE Book. I am interested in full information. (Please Check Box)

☐ Glandular
Inflammation

☐ Hernia
☐ Rectal-Colon

Name.....

Address.....

City.....State.....



out of it he fished some epoxy cement kept for gluing ferrules on his poles. He mixed the epoxy cement and hardener with pieces of his torn up shirt and stuffed this in the gearbox hole.

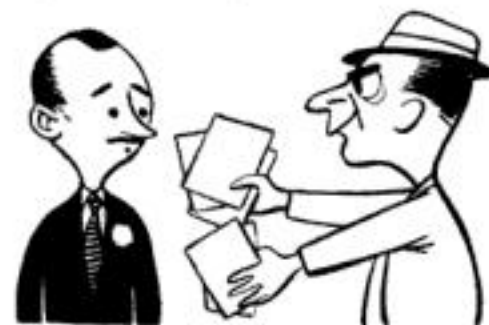
In an hour it had set and he filled the transmission with water from his water bag. By driving slowly, he made it 20 miles back to the nearest Mexican garage. They welded up the hole, gave him a refill of proper oil, and he drove back to the U.S. with no further trouble.

ROBERT B. RYAN, Torrance, Calif.

From the Horse's Mouth

"WHAT'S New in Engineering" [Oct., p. 78] reported that Olds and Buick were using alternators in place of generators on cars with air conditioners. But dealers in both cars, and factory representatives, insisted that GM was not using alternators on any 1962 models. I then wrote to you.

Armed with your letter and the original engineering material you sent me, I returned



to the Oldsmobile agency. They made further investigation and accepted my order for a new car using an alternator with their air-conditioning unit. Actually, thanks to you, I was given my choice between a 52-amp alternator and one of 90-amp capacity.

N. D. McCOMBS, St. Petersburg.

More on a Foggy Subject

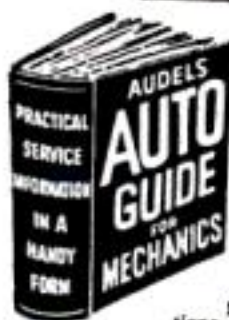
THE comments of Mr. Schmidt and your reply on why cars like foggy weather ["PS Readers Talk Back," Oct., p. 14] are open to question. I participated in a research project on water injection—a controlled test in which a Chevrolet engine was given varying amounts of water at various loads and speeds. Our test results indicated that you never get more power per pound of fuel consumed by increasing the moisture intake. Increasing exhaust temperatures gave evidence that the combustion process was slowed down. This would account in part for the fall-off in power per pound of fuel. Slowing down the rate of combustion would also provide a smoother power stroke.

Mr. Schmidt believes that the superheated steam yields additional power. I believe the superheated steam exists at the expense of part of the fuel energy.

Your statement that there is more oxygen

[Continued on page 39]

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THE FIRST PART explains the operating principles of various types of gas engines, and the function of engine parts and accessories: carburetors, fuel injection methods, cooling and lubrication systems, etc. THE SECOND PART covers trouble-shooting, modern service operations and engine tune-up procedures. Ignition system items are fully listed and illustrated. 48 pages. Only \$4.

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The march of science

Not-so-funny measles. Just about everybody gets measles. The pink spots are usually greeted with smiling relief—it isn't anything serious. But medical scientists are no longer amused. For measles can be a serious disease. While hardly in a class with cancer or automobile accidents, it kills about twice as many American children as does polio (in a population fairly well needled with Salk vaccine), and is a worrisome cause of drastic brain damage. In poorer countries, measles is a vicious plague—the death rate runs higher than 20 percent in some sections of Nigeria.

Now a remedy seems to be at hand. Measles is caused by a virus—tiny molecules that are on the borderline between living organisms and inanimate chemicals. Viruses cannot be knocked out by germ killers like penicillin, but they can be blocked in advance with vaccines, which stimulate the body to produce its own virus-dissolving antibodies.



MEASLES
VIRUS

Two main types of measles vaccines are in the works (thanks largely to Harvard's Nobel Prizeman John F. Enders, who invented a simple way to grow viruses in test tubes). One is a killed vaccine (like Salk polio shots): regular measles virus that has been killed with formaldehyde. The other is a live vaccine (like Sabin polio pills): a weakened but still living strain of measles virus cultivated from the regular virus. Both prevent measles (standard measles, that is, not the three-day German measles, which is a different disease). But neither type works quite right.

Killed vaccine takes effect slowly. At least three separate shots are needed. And the immunity does not last—booster shots are necessary, as they are with Salk vaccine.

Live vaccine avoids those drawbacks but introduces a new one: It makes the patient slightly sick. Some parents think the vaccine reaction (fever and rash) is almost as bad as the disease. One way to get around this is to mix the live vaccine with gamma globulin—a substance refined from the blood donated to blood banks. This pooled gamma globulin contains the virus antibodies of many different people and includes measles antibodies. Used alone, it makes only a temporary preventive against the measles disease. But it does temper the reaction caused by live measles vaccine.

You can expect a sheathed-claw catfight—mostly in press releases—between backers of the two vaccine types. Both are already being manufactured, for tests, by pharmaceutical companies (Pfizer makes killed vaccine, Pitman-Moore live vaccine). And measles vaccine is certain to become a large and profitable business—4,250,000 American babies are born every year, each a practically guaranteed customer. So far, neither type has been okayed for general use by the U.S. Public Health Service.

Spotting fire with radio waves. Oddly enough, firemen fighting a big blaze can't tell where the fire is. Smoke hides everything,

The march of science continued

and is often heaviest where there's no flame. A new scheme that may point right to the hot spots got a real—and successful—



workout on Los Angeles' disastrous Topanga Canyon brushfire last fall. It penetrated the smoke blanketing the area to locate the fires and map their paths.

The trick was managed with a new kind of electronic camera, a scanning microwave radiometer developed by Space-General Corp. of Glendale, Calif. This device picks up radiation from flames. It scans over a wide area, like a radar, and feeds its signals to a radarlike screen: Each pip is a flame area, the brighter the pip the hotter the flames (see photo).

During the Los Angeles fire, the radiometer scanned for hot spots from an airplane flying at 10,000 feet. Used that way, fire watchers could check 100 square miles every three minutes and pick out the danger areas that needed immediate attention.

The whale's strange treasure. People are always sending the University of Miami's Marine Laboratory samples of glop from the beach and asking, hopefully, if they have found ambergris. In the past 16 years, exactly two people have. One piece weighed less than an ounce, but the other was 200 pounds and brought its finder, Samuel Nixon of the Bahamas, about \$1,500.

For ambergris, though wildly improbable, is no myth. It comes only from the intestine of the sperm whale (apparently it's just impacted dung). When freshly excreted, it is black, sticky like tar, and, says Dr. C. P. Idyll, "stinks abominably." Most pieces are found after they have been floating in the ocean a long time. By then, the color has faded to amber or even white, and the smell has weakened to a sweetish sea odor.

The oldest, whitest ambergris is the most valuable—for, of all things, perfume. That is the only use; as a fixative, to make perfume odors last longer. It's so rare and expensive that it can be used only in the best types of perfume. The current price ranges from \$2 to \$9 an ounce.

Most lumps are small, like pebbles, but English whale expert Dr. Robert Clarke found a 926-pound boulder of ambergris in 1953. It came from a 49-foot whale caught in the Antarctic. (Ordinarily it's not easy to tell the real thing from washed up bits of wax or rubber. The Marine Laboratory, Miami, puts out a bulletin that describes identification tests.)

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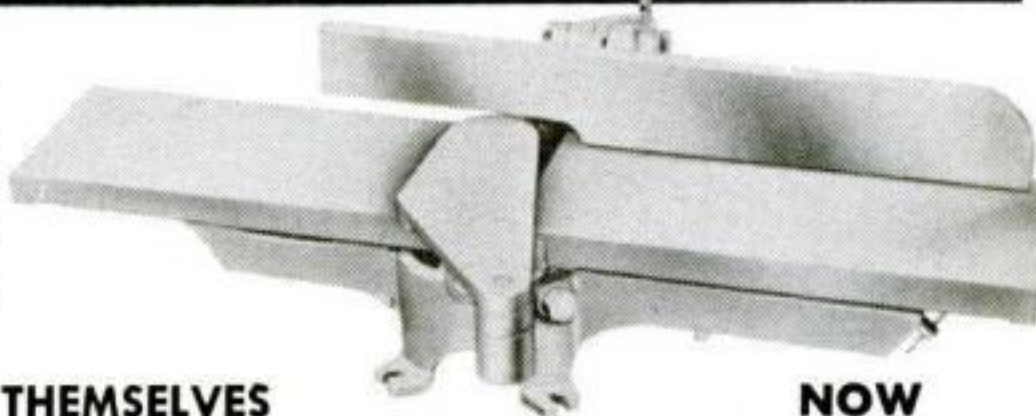
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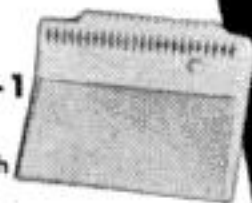
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[Continued from page 30]

in dense air than in dry is true, but the density of air is a function of temperature rather than suspended moisture. Part of the fog while passing through the venturi of the carburetor probably vaporized, which would cool the air and increase its density.

C. J. DOUTY, Valsetz, Ore.

... WATER vapor in the atmosphere displaces oxygen in the air taken into an engine and produces no power of any kind by itself. This lack of oxygen produces a richer mixture for a given volume of air taken in since the fuel jets are of fixed size. This, plus the fact that it's usually cooler on a foggy day, lowers the knock characteristics of any engine. To produce more power, a greater throttle opening is required than with a drier mixture. This will show up on a dynamometer at full throttle only.

Water injection is used on highly supercharged engines to enable more power to be drawn from them for shorter periods at the top end of the power range. The water merely acts as a cooling agent to lower the charge (induction-compression) temperature of the mixture after it leaves the supercharger. This allows higher manifold pressures without dangerous detonation.

W. W. FLEMING, N. Vancouver, B.C.

For Stars and Bullfighters?

YOU show a patent for a crosswalk light timer ["New Ideas from the Inventors," Oct., p. 110]. Over a period of years, I have seen many of these in operation on street corners around here. I think they even have one at Hollywood and Vine.

EDWARD WILKINS II, N. Hollywood.

... WE HAVE seen a similar pedestrian-crossing light timer in Bilbao, in the north of Spain. In the middle of the street was a signal—a large calibrated dial, half red, half white. A circling lighted indicator showed time remaining before a signal change. The indicator itself, changing from red to green, served as the traffic signal.

CORT KLOKE,
Barcelona, Spain.



They Beat the Dutch

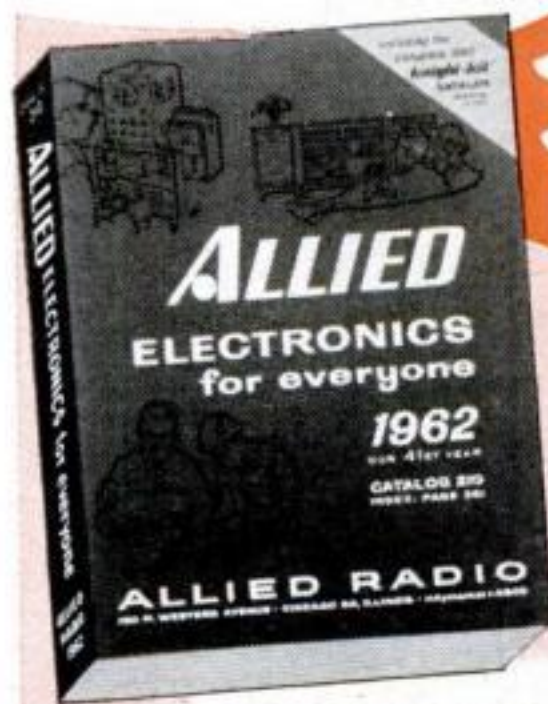
I DISAGREE with David Scott ["Overcrowded Dutch Push Back the Sea," Nov., p. 112] when he says the Netherlands is the

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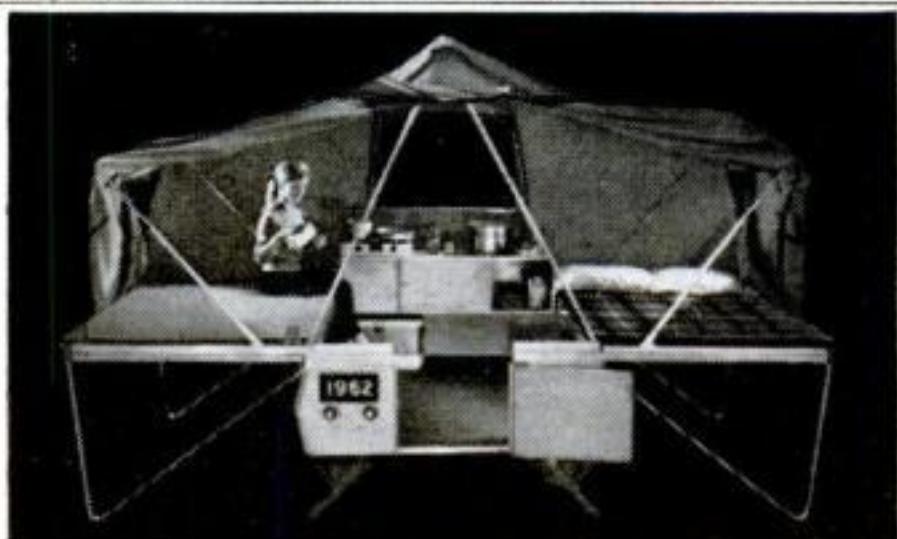
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most densely populated country in the world. I believe you'll find that Monaco holds the record (32,049.5) persons per square mile), and Vatican City and Java both are more densely populated than Holland.

PAUL C. UNANGST, Bethlehem, Pa.

The Waste Makers?

THE piece about clearing 21,000 acres of densely forested hardwood timber ["Tree Stinger Downs Forest Giants," Nov., p. 70] by simply reducing it to kindling wood with



bulldozers horrified me. This appears to be an outrageous waste of our country's resources and a costly loss to the Texas county doing it.

R. REINHART, Kingston, N.Y.

. . . I WAS shocked by the picture of that horrible monstrosity—a tourist hotel planned for the rim of the Grand Canyon ["Picture News," Nov., p. 90]. Isn't it enough that people are allowed to block our view of the countryside with ugly billboards or mar it with trash thrown along the roadways? I have never seen the Grand Canyon but many people consider it the greatest natural wonder in the world.

MRS. ROBERT GIESE, Madison, Wis.

The Grand Canyon is a National Park. Since it belongs to all the people, the editors feel that any news concerning it—good or bad—should be brought to the attention of its readers. Americans who disapprove of any plans concerning their parks should write to the National Park Service, Washington, D.C., and their congressmen.

Join-the-Scavengers Department

THE medium- or large-size liquid detergent cans make sturdy substitutes for funnels. Just cut out the bottom. Plastic bottles serve, too, and can be cut off at the bottom with a knife.

ROBERT MCRAE, Webster, N.Y.

. . . How about having some of your more ingenious readers come up with ideas on different things that can be made from motors of discarded but still operative electric shavers? I imagine a good percentage of your readers have two or three of them

CONTINUED

22 STOCKS LIKELY TO SPLIT IN 1962

The Number of Shares You Hold Could Double or Triple

Our staff, using the latest market statistics, has just completed a most timely survey. It examined the history, price, earnings potential and capitalization records of hundreds of companies for stock-split possibilities. We wanted to find out which companies might exchange 2, 3 or 4 shares of new stock for one of the old in 1962—thus increasing the number of shares held.

Out of this has come our exclusive list of 22 stock-split candidates—companies that show excellent promise. As you know, stock-splitting cuts the stock's price per share to a popular buying level. This usually attracts more investors. Demand for the stock often goes up. And often, so do prices and dividends. This list is available nowhere else, but you can have it—while this offer lasts. To clearly demonstrate the value of the Dow Theory Investment Service, we will send you this list of 22 STOCKS LIKELY TO SPLIT in 1962, together with a 30-day trial subscription to the Service. We offer this combination as a current example of the kind of useful, up-to-the-minute information our subscribers receive every week. This offer is open to new trial subscribers only. All we ask in return is the cost of postage and handling (\$1). The percentage gains shown in connection with our Model

Portfolios, Growth List and Over-the-Counter List are regularly verified by Certified Public Accountants. Changes in all are made when market conditions require, but it should not be assumed that the results in the future will be profitable or will equal the performance of the securities now included.

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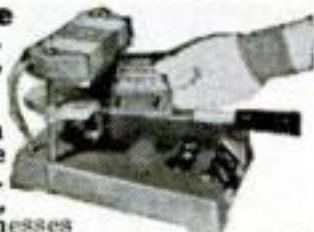
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around the house by now. Seems as if you could make a vibrating etcher for photographic purposes, adapt them to HO-gauge trains, use them to run small circulating-water pumps for displays, and so on and on. Anybody got any more ideas?

CLYDE RIELL, Vernon, Tex.

Ganging Up on Old Man Winter

Now that winter's on our backs and ice is often under the car's wheels, I'd like to pass on a dodge I've learned for controlling a car on an icy road: I hit the clutch pedal. Works like a charm!

W. C. EVANS, Vancouver, B.C.

... LAST winter my wife and I went on a long trip in our convertible and learned something we'd like other convertible owners to know.

If your ears start getting cold on a long trip because of a stretched roof (steady 60 m.p.h. or more), put the heater on defrost. The cold draft from the roof will be heated before it reaches your face and you'll be as comfortable as if riding in a sedan.

EMIL J. KUS, Passaic, N.J.

Check That Tailpipe

IT IS my understanding that all American cars since 1949 have used heaters that brought in air from the outside and heated it. Anyone sitting in a parked car ["Gus Goes to the Movies," Nov., p. 192], with the motor and the heater on, should be safe. With all the windows closed, the slight pressure created by the fan of the heater bringing in air from the outside, and with no place for it to go except through cracks, should have kept exhaust from seeping in. If this is not true, I've been driving dangerously for years.

C. B. HEADLEY, Salem, N.H.

With many car-heating systems, you have a choice of recirculating inside air or bringing in outside air. In very cold weather, you'd recirculate inside air. Also, you've forgotten the condition of the tailpipe—presumably the one in your car is not bent like a pretzel.

Tip for Wagon Owners

WAGON owners may be interested in my method of keeping the rear window clean. I attached air deflectors (\$5.65 from a mail-order house) and now my rear window stays cleaner than the windshield.

The deflectors strike at the cause by scooping air from the side of a moving car and partially, or totally, eliminating the vacuum and turbulence at the rear. I find them better than mud flaps.

LEO A. ROGACKI, APO, NY.

Reading Time: Less than two minutes.

Benefits You Will Receive: A few moments taken now may save you months of expense later.

Would you welcome a HOSPITALIZATION POLICY in which:

1. ONLY YOU CAN CANCEL

Regardless of how many times you are hospitalized the Company could never cancel your policy. Each time you were hospitalized you would receive \$100 each week for as long as you remain in the hospital . . . for life if necessary!

2. NO AGE LIMIT

Whether you were 1 or 100 you would receive the *same* liberal coverage.

3. ALL BENEFITS PAID IN CASH

Claim checks would be made payable directly to you — tax free — to use as you wish!

4. NO WAITING PERIOD

All your benefits begin immediately on noon the day your policy is issued.

IF you do not drink and **IF** your doctor has not already told you that it's time for you to enter the hospital . . . then you are eligible to apply.



For complete information **TURN TO THE NEXT PAGE.** Read it carefully. See what prominent leaders say about **THE GOLD STAR PLAN.** Read what happy policyholders write. And be sure to read the **MONEY-BACK GUARANTEE.**

At Last- A HOSPITALIZATION

Pays \$100.00 Weekly from First Day for Life to Readers of POPULAR SCIENCE MONTHLY



day in the hospital and will continue paying as long as you are there, even for life!

If you do not drink and are carrying ordinary hospitalization insurance, you are of course helping to pay for the accidents and hospital bills of those who drink. Alcoholism is our nation's #3 health problem, ranking immediately behind heart disease and cancer! With the

If you are the one American in four who does not drink, the Gold Star Total Abstainers' Hospitalization Policy will pay you \$100.00 a week in cash, from your first

GOLD STAR PLAN you are not called upon to help pay the high bills for the ailments and accidents of those who drink. GOLD STAR rates are based on the SUPERIOR HEALTH RECORDS of Non-Drinkers!

For the first time, you can get the newest and most modern type of hospitalization coverage at unbelievably low rates, because the Gold Star Policy is offered only to non-drinkers. And your low Gold Star premium can never be raised because you have grown older or have had too many claims. Only in the event of a general rate adjustment up or down for all policyholders can your rate be changed!

One out of every seven people will spend some time in the hospital this year. Every day over 64,000 people enter the hospital—47,000 of these for the first time!

LOW RATES FOR NON-DRINKERS

With a Gold Star Total Abstainers' Hospitalization Policy, you receive \$100.00 per week in cash, as long as you remain in the hospital, starting from your very first day there, for either sickness or accident. If your hospital stay is less than one week, you still collect at the rate of \$14.29 per day. Even if you are already covered by another policy, the GOLD STAR PLAN will supplement that coverage, and will pay you directly, in addition to your present policy. And your benefits are tax-free!

This wonderful, generous protection costs only \$4 a month for each adult, age 19 through 64, or \$40 for twelve full months. For each child under 19, the rate is just \$3 for a month's protection. And for each adult of

age 65 through 100, the premium is only \$6 a month, or \$60 for a full year.

And remember, with Gold Star, the NO LIMIT Hospital Plan, there is NO LIMIT on how long you can stay in the hospital, NO LIMIT on the number of times you can collect (and the Company can never cancel your policy), and NO LIMIT on age!

Compare this plan with others. We welcome comparison because the GOLD STAR PLAN pays from the very first day (we can't pay any sooner); and it pays forever . . . as long as you remain in the hospital (we can't pay any longer!).

OUTSTANDING LEADERS SAY:



JEROME HINES, leading bass with the Metropolitan Opera Company: "The non-drinker is a better risk and should be entitled to a better insurance rate. There has long been a need for a special hospital plan for total abstainers. Having known Art DeMoss for a long time, I am most happy to recommend this low cost Gold Star Policy. It should prove to be a real help and blessing to all who can qualify."



DR. DANIEL A. POLING, noted minister and Editor of The Christian Herald: "The advantages of a hospital plan which is available to non-drinkers only are obvious. The lower rate is made possible because you are not paying the bills for the illnesses and accidents of those who use alcohol."



J. C. PENNEY, philanthropist, Founder of the J. C. Penney Company: "I have a sincere conviction that liquor is one of the chief causes of unhappiness both to the people who drink and to those who are near and dear to them. Early in my life I decided not to touch liquor. I am delighted to know of the De Moss Gold Star Total Abstainers' Plan that provides a premium rate so much lower. This is the way it should be because most automobile and other accidents occur because of drinking."

GUARANTEE

Money-Back Guarantee

We'll mail your policy to your home. No salesman will call. In the privacy of your own home, read the policy over. Examine it carefully. Have it checked by your lawyer, your doctor, your friends or some trusted advisor. Make sure it provides exactly what we've told you it does. Then, if for any reason whatsoever you are not fully satisfied, just mail your policy back within ten days, and we'll cheerfully refund your entire premium by return mail, with no questions asked. So you see, you have everything to gain and nothing to lose.

READ WHAT A BLESSING THIS PROTECTION HAS BEEN TO OTHERS:

ROBERT F. HAINES—Ukiah, California: "It is with high praise I recommend this Company. My experience has been very satisfactory, and when help was needed most, you were there."

MR. HENRY T. ALFORD—Camden, Illinois: "We received your letter by special delivery enclosing the check for payment in full for eight days spent in the hospital. We are well pleased and want to say thank you."

NEWTON HAYES—Plattsburgh, New York: "Thank you for your very prompt payment of the claim for Mrs. Hayes' accident. Your Gold Star Policies deserve wide-spread and enthusiastic requests for coverage from those qualified to enjoy them."

MR. T. S. ELLIOTT—Pittsburgh, Pennsylvania: "I was very happy to receive your check in payment of my hospital benefits. I'm sorry that a claim arose so soon after my becoming insured, but it gave us a feeling of security for the future."

MR. HARLEY E. JACOBS—Rushsylvania, Ohio: "We received our check. Many, many thanks! It will surely help us out. We had only paid premiums for three months."

MR. OTTO S. GOERTSEN—Cass City, Michigan: "We want to thank you for your efficient manner in handling our claims, and we shall do our best in advising others regarding your service."

PLAN FOR NON-DRINKERS ONLY!

**NO WAITING PERIODS
NO AGE LIMIT**



**ONLY YOU CAN CANCEL
NO SALESMAN WILL CALL**



Check These Remarkable Features:

- Only YOU can cancel.
- Good anywhere in the world!
- Pays in addition to any other hospital insurance you may carry.
- All benefits paid directly to you in cash—tax free!
- Claim checks are sent out Air-mail Special Delivery!
- No age limit.
- Immediate coverage! Full benefits go into effect noon of the day your policy is issued.
- No limit on the number of times you can collect.
- Pays whether you are in the hospital for only a day or two, or for many weeks, months, or even years!
- No policy fees or enrollment fees!
- Ten-day unconditional money-back guarantee!
- Every kind of sickness and accident covered except, of course, hospitalization caused by the use of alcoholic beverages or narcotics, pre-existing conditions, pregnancy, or any act of war. Everything else IS covered.

HERE ARE YOUR GOLD STAR BENEFITS

Pays you \$100.00 weekly for life while you are in the hospital.
Pays \$2,000.00 cash for accidental death.
Pays \$2,000.00 cash for loss of one hand, or one foot, or sight of one eye.
Pays \$6,000.00 cash for loss of both hands, or both feet, or sight of both eyes.

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- 1 Fill out application below.
 - 2 Enclose in an envelope with your first payment.
 - 3 Mail to De Moss Associates, Inc. Valley Forge, Pa.
- You will receive your GOLD STAR POLICY promptly by mail.

No Salesman will call.

APPLICATION FOR Gold Star Total Abstainers' Hospitalization Policy

My name is _____ 1-6901-022
Street or RD# _____
City _____ Zone _____ State _____
Date of Birth: Month _____ Day _____ Year _____ Height _____ Weight _____
My occupation is _____
My beneficiary is _____ Relationship _____
I also apply for coverage for the members of my family listed below:

	NAME	AGE	HEIGHT	WEIGHT	BENEFICIARY
1.					
2.					
3.					

To the best of your knowledge and belief, have you or any person listed above ever had high or low blood pressure, heart trouble, diabetes, cancer, arthritis or tuberculosis or have you or they, within the last five years, been disabled by either accident or illness, had medical advice or treatment, taken medication for any condition, or been advised to have a surgical operation? Yes _____ No _____

If so, give details stating person affected, cause, date, name and address of attending physician and whether fully recovered: _____

Neither I nor any other person listed above uses alcoholic beverages, and I hereby do apply for a policy with the understanding that the policy will not cover any conditions existing prior to the issue date, and that it shall be issued solely and entirely in reliance upon the written answers to the above questions.

Date: _____

Signed: **X**

FORM GS 713-3

**HERE
ARE
THE
LOW
GOLD
STAR
RATES**

	IF YOU PAY MONTHLY	IF YOU PAY YEARLY
Each adult age 19-64 pays	\$4.	\$40.
Each adult age 65-100 pays	6.	60.
Each child age 18 and under pays	3.	30.

SAVE **16 ²/₃ %**
BY PAYING YEARLY!

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Valley Forge, Penna.

OLD SECURITY LIFE INSURANCE COMPANY
Kansas City, Missouri

WORLD MUTUAL HEALTH & ACCIDENT INS. CO. OF PENNA.
King of Prussia, Pa.

MAIL THIS APPLICATION WITH YOUR FIRST PREMIUM TO

DE MOSS ASSOCIATES, INC. VALLEY FORGE PENNA.



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Pours Like Honey—Sets Like Glass!



The pansy shown in this photograph was embedded in crystal-clear Castolite in 1946. It is as lovely now as the day we picked it in our garden. NOW—a greatly simplified method enables you to do the same with Castoglas on wood, hardboard, metal or between layers of glass mat.

What Can You Do With Tiles? A good example is the way a dark and outmoded kitchen was converted into a bright and cheerful room at surprisingly modest cost. Castoglas was used in three ways: for making the decorative glass screen, for the tiles with embeddings of leaves and butterflies, and for "glassing" the countertop. Castoglas is waterproof, heat- and acid-resistant and easily cleaned. You can also make table tiles, coasters, trays, wall decorations and embed photos, coins, sea shells and many other things. No tools, no heat required. New illustrated booklet explains in easy-to-follow directions how to do it. Please mail 25c to Dept. 2-B

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17-Jewel Watch \$2.87



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NEW Catalog 2700 Novelties



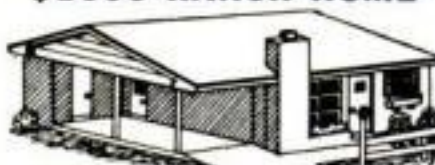
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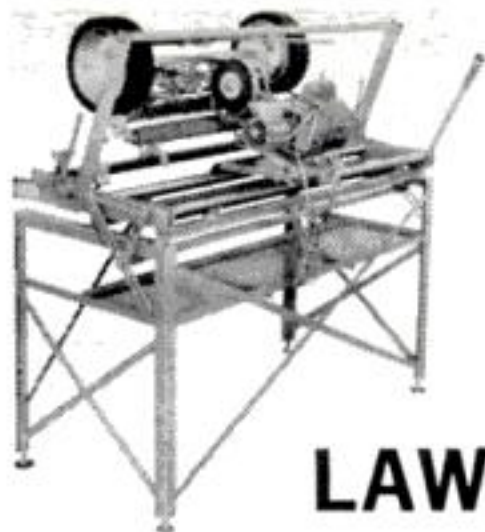
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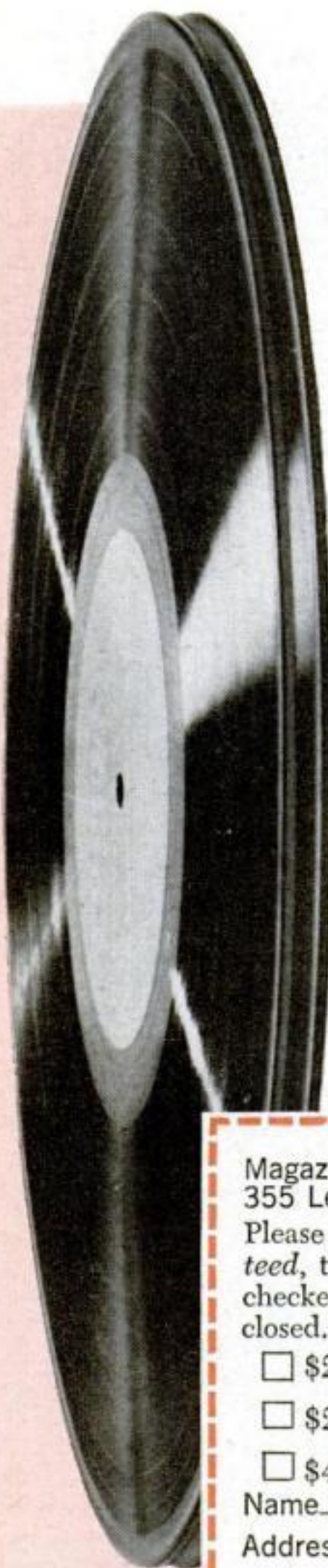
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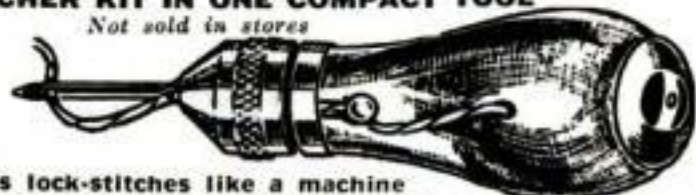
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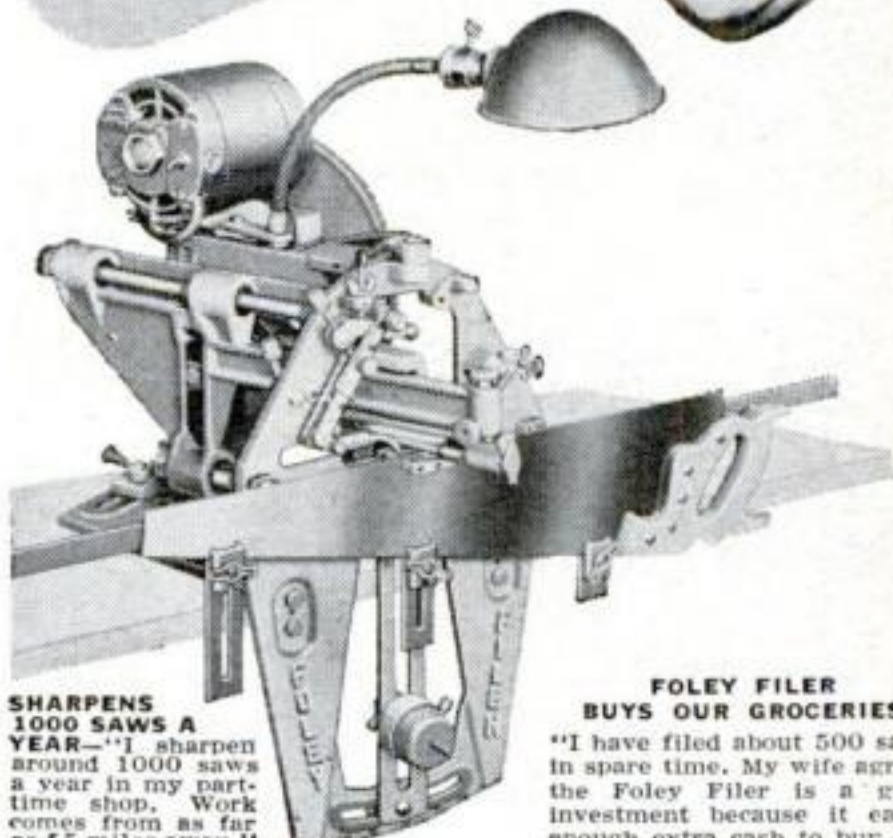
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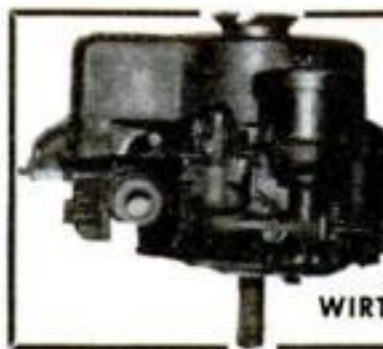


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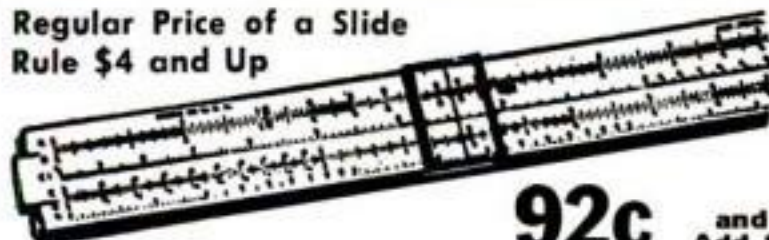
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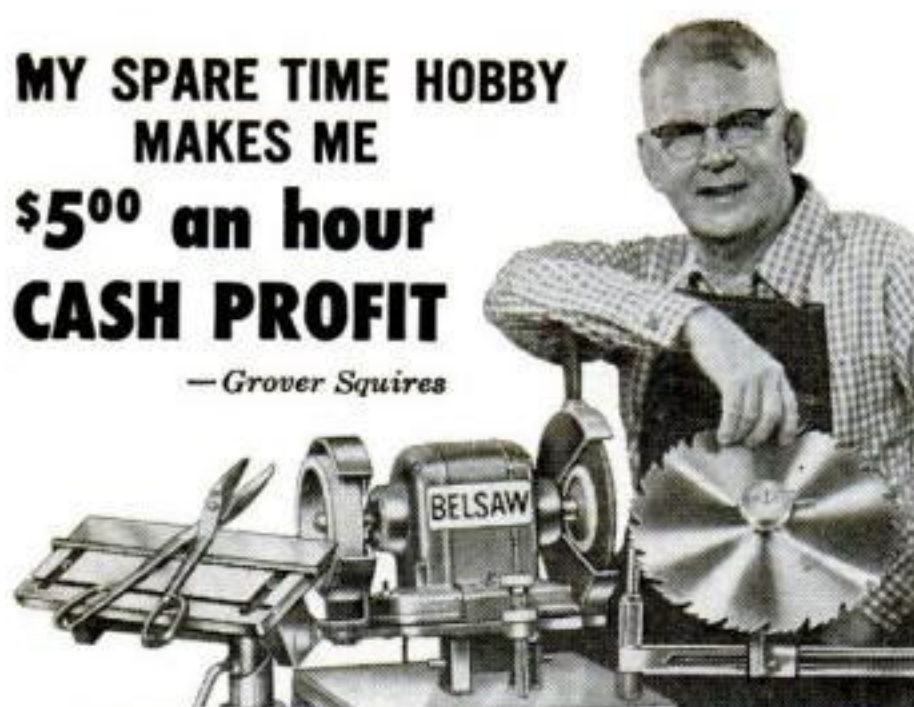
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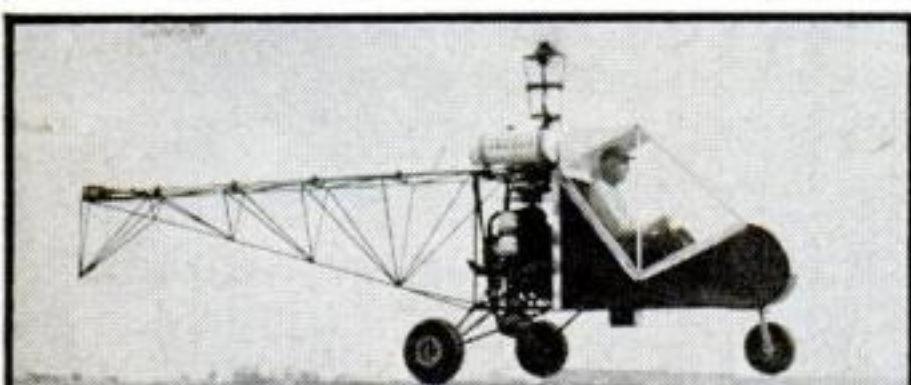
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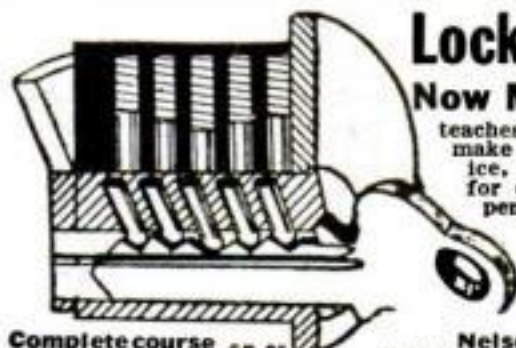
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A number of one-man mail order enterprises are paying their owners an income of \$40,000 to \$50,000.

SPECIAL OPPORTUNITIES



Mail order is big business. Annual catalog sales volume of Sears, Roebuck and Co. is over 700 million dollars!

HOW TO START

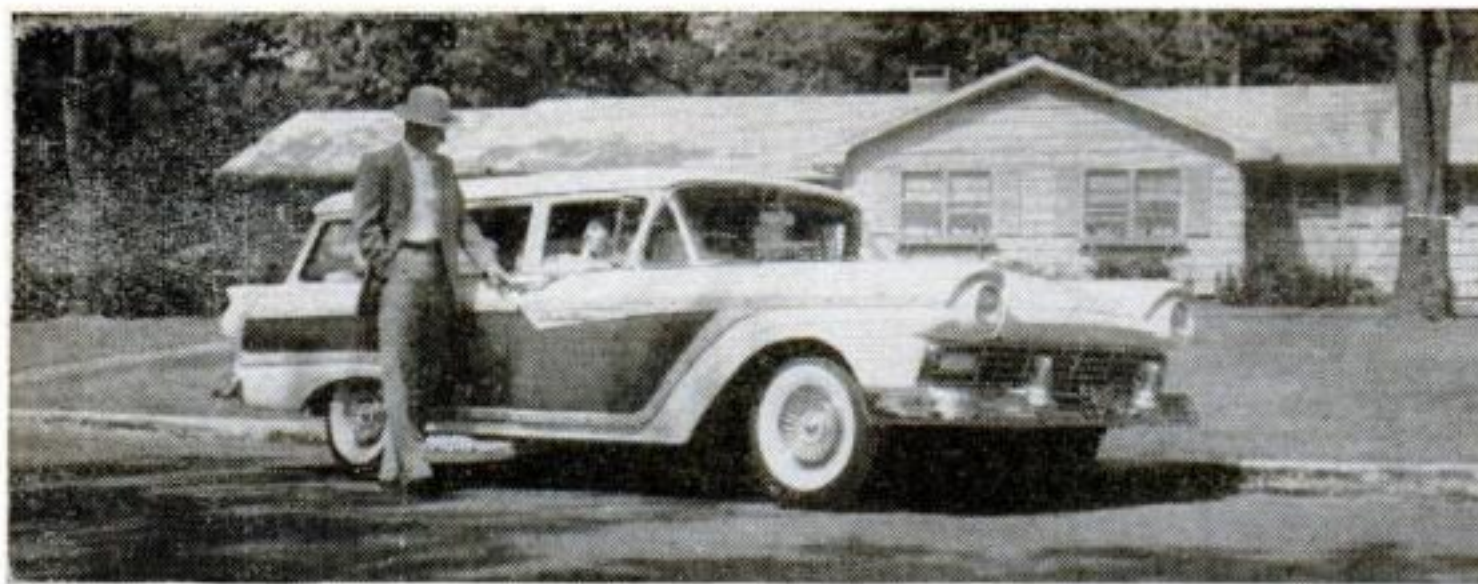
Your Own Mail Order Business

You can make a fortune by mail. New firms will set you up in a fabulous mail order business of your own! They'll make up your catalogs, prepare your advertising, supply mailing lists and even ship your products for you!

By Robert Stephenson

When Anthony Sambati injured his back and was laid off from work he never dreamed it would be a blessing in disguise. Bedridden for weeks, he decided to start a small mail order business. This was something he could run right from his own home and required very little capital to begin. In fact, Sambati started with less than \$85.00.

(Advertisement)



After a short time in mail order, Sambati soon had a beautiful home with all the luxuries of a successful businessman.

He figured that a small mail order business might provide a temporary income to support his family until he got back on his feet. His first step was to obtain a franchise from a large wholesale mail order firm which supplied him with all the necessary catalogs and mailing literature. It wasn't long until his spare-time venture blossomed into a booming enterprise. Drawing a small salary and pouring the rest of the profits back into the business, he soon had others working for him! Today he owns a large retail store, his own warehouse and a beautiful home with all the luxuries of a successful businessman.

Sambati's story is typical of a number of men and women who began a small mail order business with absolutely no previous experience, and made a huge success of it. These 'little' people are quietly pocketing big profits every day—many content to keep the business small . . . spending an hour or two each day in the privacy of their own home. No bosses, time clocks or small pay envelopes. No door to door selling, in fact, you never even meet your customers face to face.

Yes, a small one-man mail order business is ideal for anyone wanting a chance to gain financial security and independence. Yet thousands try mail order each year and fail, simply because they don't learn the few simple secrets of success early in the game.

Take the case of Bud Sheer who had been working for a theatre in a small New Jersey town. With only a few hours spare-time to spend each morning, he tried mail order to supplement his regular income. Like many beginners in this field, Sheer was faced with the problem of finding good mail order items which would have a high mark-up and repeat sales potential. But the biggest obstacle was the expense of printing a catalog.

Then he heard about the A. J. Statile Co. of Hillsdale, New Jersey — an organization set up to aid the small mail order beginner.

He wrote to A. J. Statile Co. for full information, sent in his application for a franchise and within a short time the cash began rolling in. Today Bud Sheer *owns* the theatre he once worked for. Sheer attributes his success in mail order to the A. J. Statile Co. Actually, the theatre he owns has become a side investment.

He still uses the beautiful 300 page mail order catalogs supplied by A. J. Statile Co.

How does the Statile Co. help the beginner get a sound start in mail order? Very simply. Just as Henry Ford made automobiles within the reach of the general public—by mass production and large volume.

Let's take a few specific examples:

(1) All franchised dealers of A. J. Statile are offered ready to mail catalogs and sales literature. Each mailing piece has the dealer's name and address printed right on it. By printing millions of catalogs, Statile is able to offer these at a fraction of their regular cost. The artwork and layout costs for these catalogs would run into thousands of dollars for the beginner if he were starting from 'scratch'.

(2) Since all mailing material and catalogs contain your name and address, all orders come directly to you. Yet you don't have to invest one penny in inventory. All merchandise is stocked for you. In fact Statile has over \$3 million dollars worth of mail order merchandise at your disposal.

(3) All packaging and shipping is done for you. You simply send a shipping label to Statile together with the wholesale cost of the items, and the merchandise is shipped directly to your customers under your own shipping label.

(4) A consultation service is provided to answer any questions you may have. You receive a secret list of over 100 national magazines which run free ads. You'll be shown how to obtain free publicity on your own mail order items. In addition, you obtain trade names and addresses of over 150 other mail order wholesalers who drop-ship top mail order items for you. You'll also be given all the government laws and regulations pertaining to a home operated mail order business. These laws are a 'must' for all beginners.

All this valuable information is covered in the Statile Mail Order Survey which every new franchised dealer receives from Statile before they begin. Formerly sold for \$25.00, this survey has become the 'bible' of the trade. Mr. J. M. of Baltimore, Md., writes, "To tell the truth, all the information in regard to obtaining free ads is alone worth the \$25.00 I paid you . . ." J. D. of Kalamazoo, Mich.,

(Advertisement)

states, "Just a personal note to say I am most satisfied with my \$25.00 investment. Your sales plan is simple and well organized . . ." These are only a few of the many testimonials received praising the Statile Mail Order Survey.

(5) The catalogs and mailing literature offered by Statile Co. cover every conceivable mail order item. You select the field you are interested in . . . **BABY ITEMS, TOYS, APPLIANCES, VITAMINS, BOOKLETS AND**



The thrill of receiving money in your morning mail is one you'll never tire of.

MAIL ORDER COURSES, you name it, Statile has the catalog or mailing piece. Select your market, order your mailing literature and you're in business.

(6) You'll be told how to compile your own mailing lists—and this is the most important part of your business. Many a beginner has fallen by the wayside simply because he mails his catalogs to a poor list of names. Suppose, for example, you offered a beautiful scale model of a 40' Chris-Craft cabin cruiser by mail. You would probably make your mailings to boating enthusiasts and the chances are that nine times out of ten your mailings would show a loss instead of a profit. How would Statile help you solve this particular mailing list problem? He would show you where to get the names and addresses of *actual owners* of 40 foot Chris-Craft cabin cruisers! Surely every owner would like to have a scale model of his own boat. Strange as it may seem, such a mailing list is available to anyone. The secret is where to find it. This is just one example of how an experienced mail order expert giving you personal advice, may mean the difference between success and failure!

This same method of obtaining selective specialized mailing lists may be applied to practically any market . . . selling baby items to new mothers, selling toys to young children, etc., etc.

So much for starting your own mail order business. Now, a word of caution. **OBTAIN YOUR MAIL ORDER FRANCHISE FROM A**

REPUTABLE MAIL ORDER FIRM. Unfortunately, during the past few years a number of ads have appeared in newspapers and magazines offering to start people in mail order. The ads are grossly misleading. Many imply that you can become a millionaire over night if you use their catalogs. Beware! Particularly if they operate their own mail order business direct to the consumer. These firms compete with their own franchised dealers! They could just as well mail all the catalogs themselves. They don't need you.

Other shady firms fail to drop-ship your orders promptly, thereby losing customers for you. In mail order, prompt shipment is an absolute requirement for a successful operation.

Deal only with firms whose business is preparing catalogs and shipping merchandise. They operate on a strict wholesale basis for franchised dealers exclusively. Such a firm is the A. J. Statile Co. Letters from successful franchised mail order dealers speak for themselves. A woman from Milwaukee writes, "It has been better than my expectations." A gentleman from California states "we are quite pleased with the response we are receiving." Another man from Wisconsin writes, "To say the least, I am more than satisfied."

Yes, a small mail order business offers you an opportunity to earn a second income, or—if you work at it in earnest, a chance to strike it rich. The young housewife in St. Louis may be content to make an extra \$20.00 a week . . . the office worker in Los Angeles may be aiming for \$150.00 weekly full time business . . . and the ambitious schoolteacher in Newark may reach \$20,000.00 a year. What is your objective? Set your own goal, pick your own hours, and the sky is the limit.

Even a government report stated that a number of the most successful one-man mail order enterprises make as high as \$40,000 to



Big firms will carry all stock for you. They ship orders direct to your customers using your own shipping labels.

(Advertisement)

Your Own Catalogs of Top Mail Order Items!



A. J. Statile Co. will prepare your catalogs, write your sales letters, supply mailing lists and even ship merchandise for you, using your own shipping labels!

\$50,000 a year! But frankly, this is the exception rather than the rule. Most mail order operators are content to earn a comfortable living doing little physical work, but enjoying their work thoroughly! We don't say you'll be a mail order millionaire or another Sears & Roebuck, but if you're looking for a business of your own with financial security, the answer is mail order. If you've already tried mail order with little or no success, don't give up! Try to analyze what went wrong. Success comes only to those who keep trying and learn from their own mistakes. Again we emphasize, deal only with a reputable firm.

The A. J. Statile Co. has been in business for over twelve years.

They gladly furnish bank or trade references upon request. They are probably one of the largest mail order wholesalers in the country. Whether it be toys, gifts, vitamins or appliances—they've got it ready to ship under your label **WITHIN 24 HOURS!**

Firmly convinced that no other business offers the tremendous opportunities of mail order, A. J. Statile, president of the firm, is an outspoken advocate of the man or woman who wants to start in business for himself. As Statile puts it, "by all means, start your own business and start **NOW!** If you want a chance at security and financial independence make your choice mail order. There's nothing like it. Absolutely nothing!"

FOR FREE DETAILS

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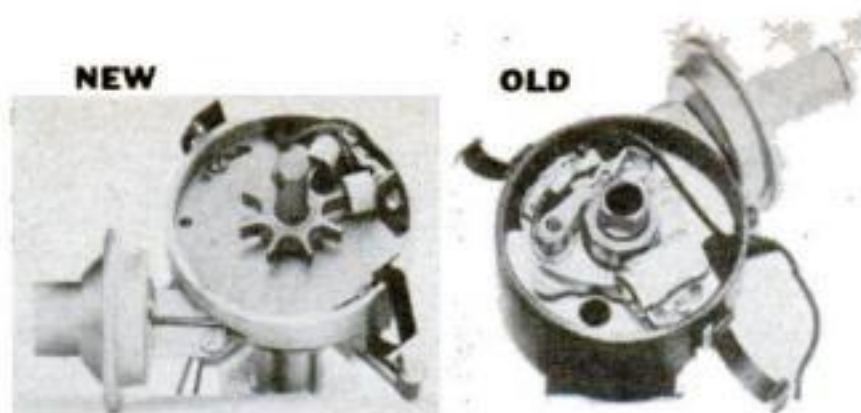
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DETROIT REPORT

Good-bye breaker points

THE first radical change in car-ignition systems in 40 years has been announced by Motorola. It could mean good-bye to distributor breaker points—requiring periodic replacement—forever. The secret: transistors.

Motorola's system uses a magnetic pulse generator, a transistorized pulse amplifier, and an ignition coil. The transistor amplifies the pulse in somewhat the same fashion as a magneto in a lawn-mower engine. In place of the breaker points is the pulse generator. This is a small, toothed wheel (see picture) that rotates past a tiny magnet without touching it. Since there's no contact, there's no wear, nor even the necessity for adjustment. The pulse is constant at all engine speeds—there's no



misfiring at high speeds. The spark is hotter, the battery drain lower. The system, says Motorola, is good for the life of the car.

Other transistorized ignition systems are in the works. A variation still uses breaker points. They trigger a transistor that acts as a switch between coil and distributor. This lowers the voltages involved. Points last longer, performance and fuel economy go up.

Besides Motorola, Holley Carburetor, GM's Delco-Remy division, and the Ford-owned Electric Autolite Co. have been working on transistorized ignition systems.

Flossier Volkswagen coming.

The VW 1500, the Volkswagen that can't be distinguished at a cursory glance from a Simca, Opel, or English Ford, is going to be sold in the U. S.—as predicted by POPULAR SCIENCE last

September. Official introductory date is *next* September, and from the looks of the production schedule, there are going to be precious few of them in VW showrooms. Price? A good guess would be around \$2,000 at Atlantic ports of entry.

Antismoggers (cont.). The auto industry has agreed to equip all 1963 models with the crankcase blowby device that is already a "compulsory option" on new cars sold in California. The gadget burns up smog-causing hydrocarbons that collect in the crankcase when a car ages and starts burning oil. It will reduce smog-forming exhaust by roughly a third. The rest of the smog emissions are more expensive to eliminate. The blowby attachment is simple,

being essentially a replacement of the crankcase draft tube that has vented vapor to air, substituting for it a tube that leads to the intake manifold. They say it will add \$6 to the price of a new car.

The step was forced by Secretary of Health, Education, and Welfare Abraham Ribicoff, who summoned Detroit brass and told them to do it "voluntarily" before he asked Congress for a law requiring it.

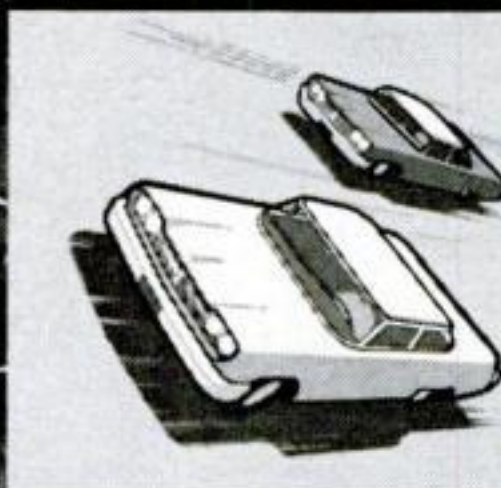
Glass radiators. An increasing amount of plastic reinforced with glass fibers will be used in 1963 cars, and probably even in the 1962 crop. It's likely that in the current model year

Ford will bring out a fiber-glass radiator reservoir tank. The tank improves engine cooling because an extra chamber in it helps bleed air from the coolant. It's cheaper to make, too.

New broom. That "Valiant look," so pronounced on many of the Chrysler Corp. 1962 cars, is likely to disappear by 1964. Reason: a new styling vice-president named Elwood Engel. Engel

is a no-fin man, so the last of these protuberances should wither away. A complete restyling job on the entire stable will be in order for '64. (Not for '63, because that tooling is done.)

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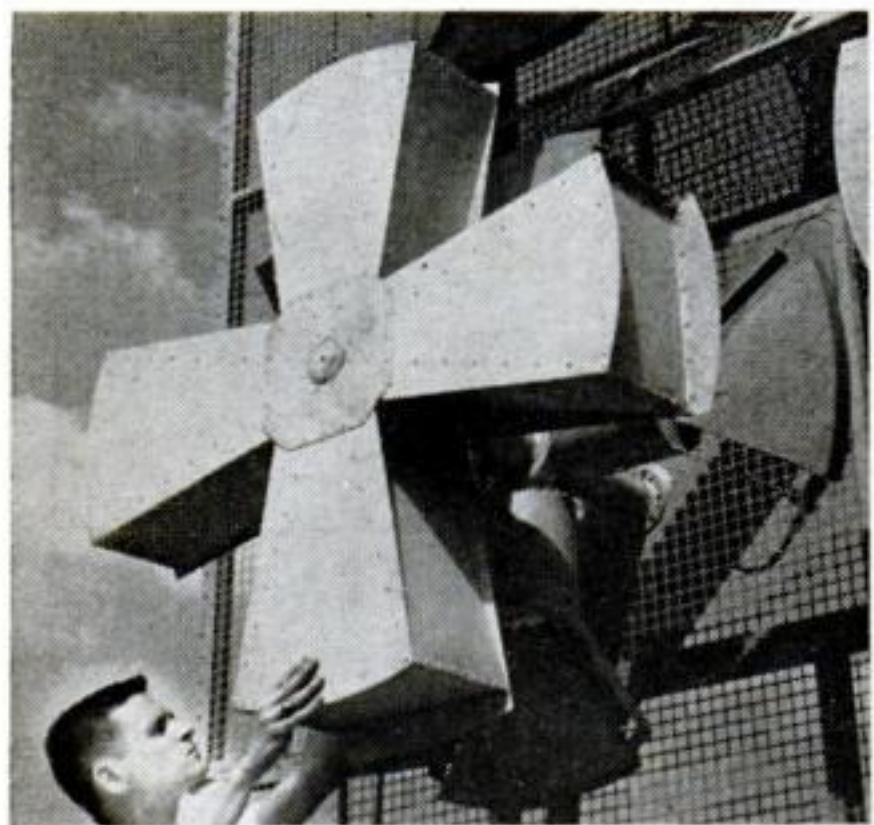
Throwaway litter bags

Huge disposable paper bags have replaced conventional litter baskets on superhighways near Göttingen, West Germany. Brackets on each side secure the 100-pound capacity bags to covered rims. The new receptacles are more sanitary and are easy to service.



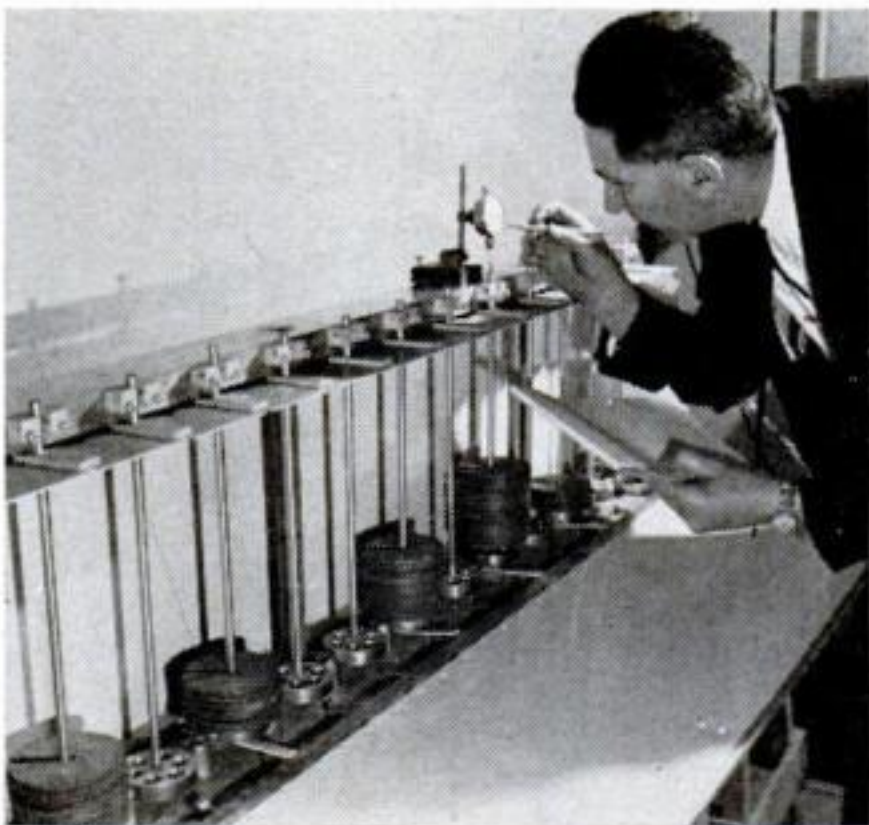
Space-saving storage

Latest trick for saving valuable space in factories is a system of storage bins stacked from floor to ceiling. Retriever shown in center is powered by four heavy-duty electric motors that enable it to cruise along the narrow aisles and to lift loads for storage or remove them.



Four-way antenna

Four different kinds of antennas are incorporated in the "Maltese cross" above. The multipolarized aerial is used on the Navy's Range Tracker, first vessel assigned to track missiles and space vehicles over the Pacific Missile Range. Chance Vought developed it to avoid shutdowns while changing elements to receive different types of signals. Its polarization can be shifted either automatically or by remote control.



Multiple creep tester

This bank of 15 rods accurately measures the strength of laminated plastic used in tools. One- and five-pound weights placed on the loading rods and over the specimens apply stress at fixed temperatures for 500 hours. The gauge determines how much shifting of layers takes place in each strip. Known as a creep tester, it saved about 5½ years and 80 percent of the cost on a 1,000-specimen test program for Boeing.

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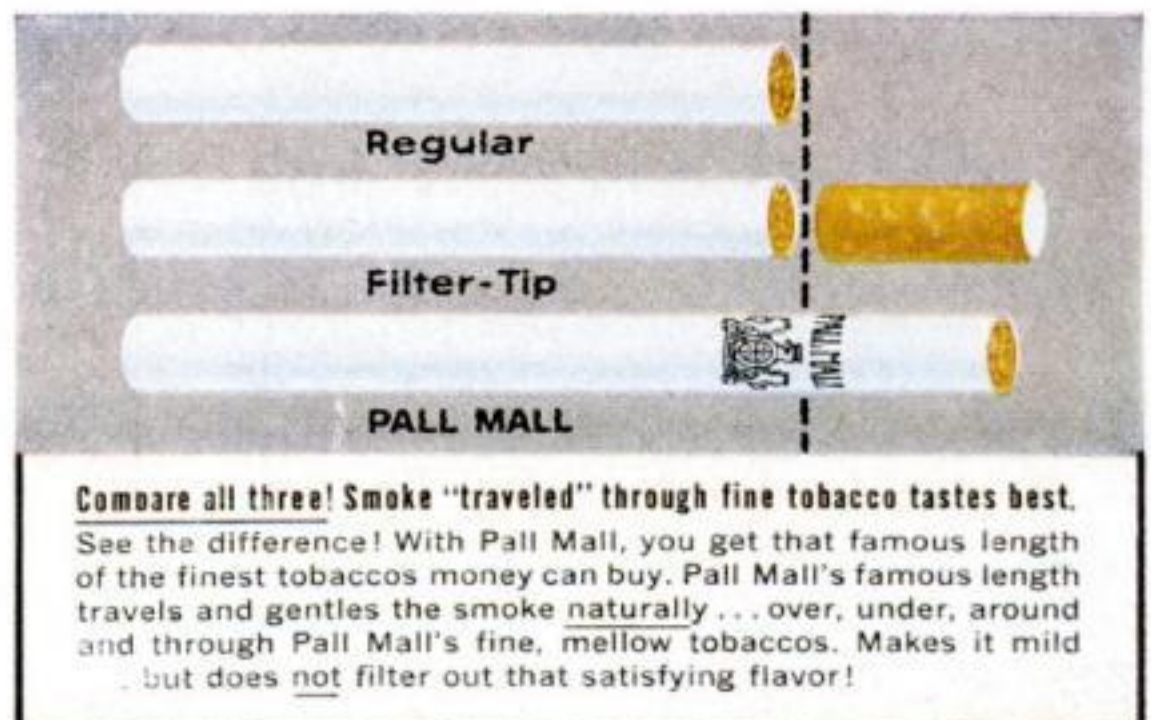
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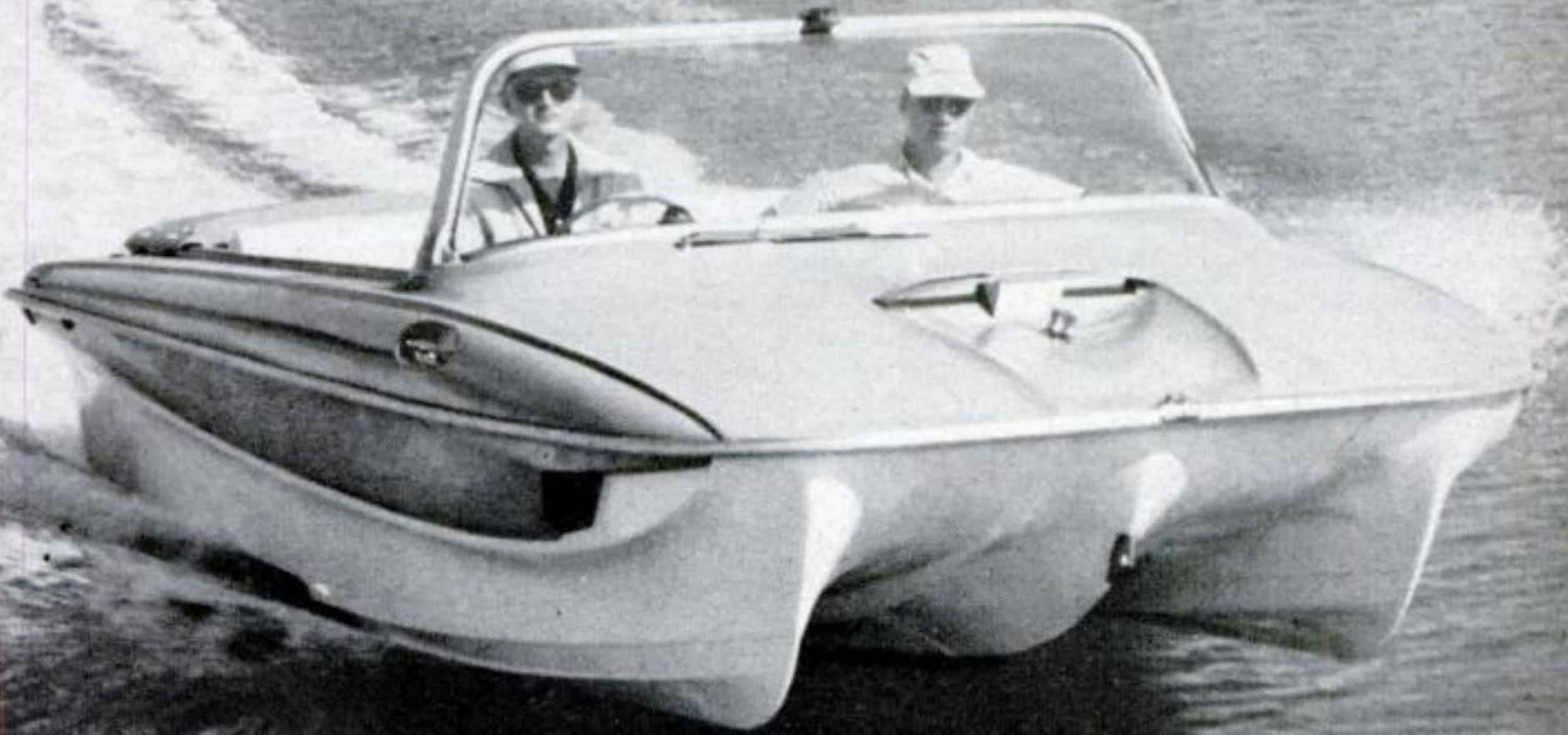


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Dreamboat for Everybody

by Hubert Lockett

PS PHOTOS BY W. W. MORRIS

THE ODD-LOOKING 17-footer above is not just another one-of-a-kind experimental hull. It is one of the most exciting pieces of boating news for 1962: the shrewdly conceived entry of the Outboard Marine Corporation—the GM of small-boat power plants—into the mass-produced family-boat field. It costs about as much as a car and is easier to handle. For a ride behind the wheel, turn the page; for facts and features, see page 68.

Dreamboat: Racing, sauntering, or turning, she's a delight to handle



CENTER BOW IS OUT OF WATER at planing speeds. Wide-spaced planing surfaces give a broad base of support. One sponson tends to resist the swerving forces acting on the other.



AT LOW SPEEDS, the center bow gives added lift to help the bow rise over waves. Spoiler ridges on either side of the center bow prevent water turbulence around the propeller.

WE WERE drifting in mid-channel with the engine cut when I took over the controls of the most remarkable pleasure boat I have ever had the pleasure of operating. It was a sun-drenched morning last December. Scene: the channel leading to the blue waters of the Gulf near Naples, Fla.

In a day filled with surprises, my first one had come when my companion stepped nonchalantly from the dock to the gunwale of this 17-foot family run-about. I awaited the windmilling arms and sudden dunking that usually follow this common landlubber's mistake. He just stood there, inviting me to join him on the gunwale. With some uneasiness I stepped down. The stability was startling—almost like stepping into my convertible.

That sense of incredulity recurred all day as I put the boat through every outrageous maneuver that I thought an inexperienced boatman might try.

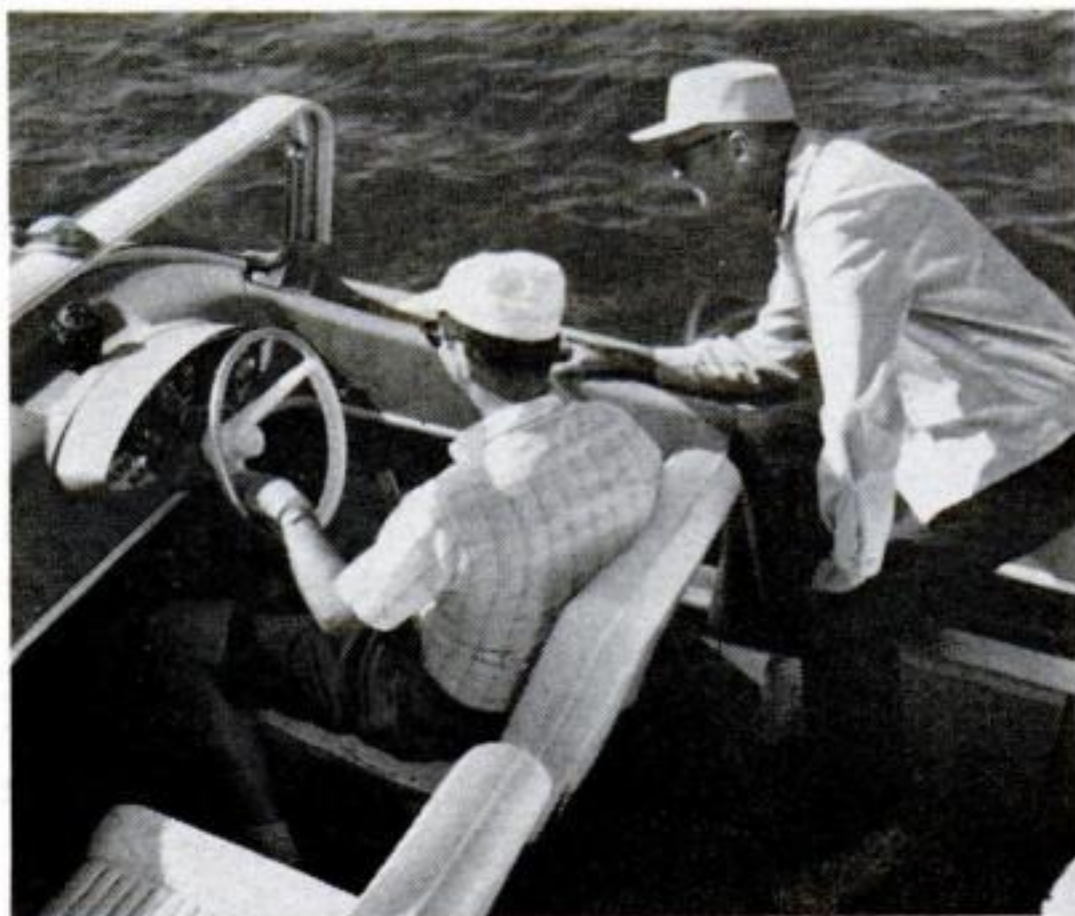
In the driver's seat. As I slipped behind the wheel and key-started the engine (which gives a low but businesslike 80-hp. thrumble), I wondered about the compromises its designers must have made. It seemed likely they'd given up a lot in performance and handling to get such amazing stability. Seen from above at the pier, the hull had looked rather like a plush, but decapitated, little houseboat. The boat was beamy—scarcely $2\frac{1}{2}$ times longer than wide. From the driver's seat you look forward over a blunt, scowl-like bow. If you've ever taken a catfish off a trotline, you've

seen a bow that's very much like this one.

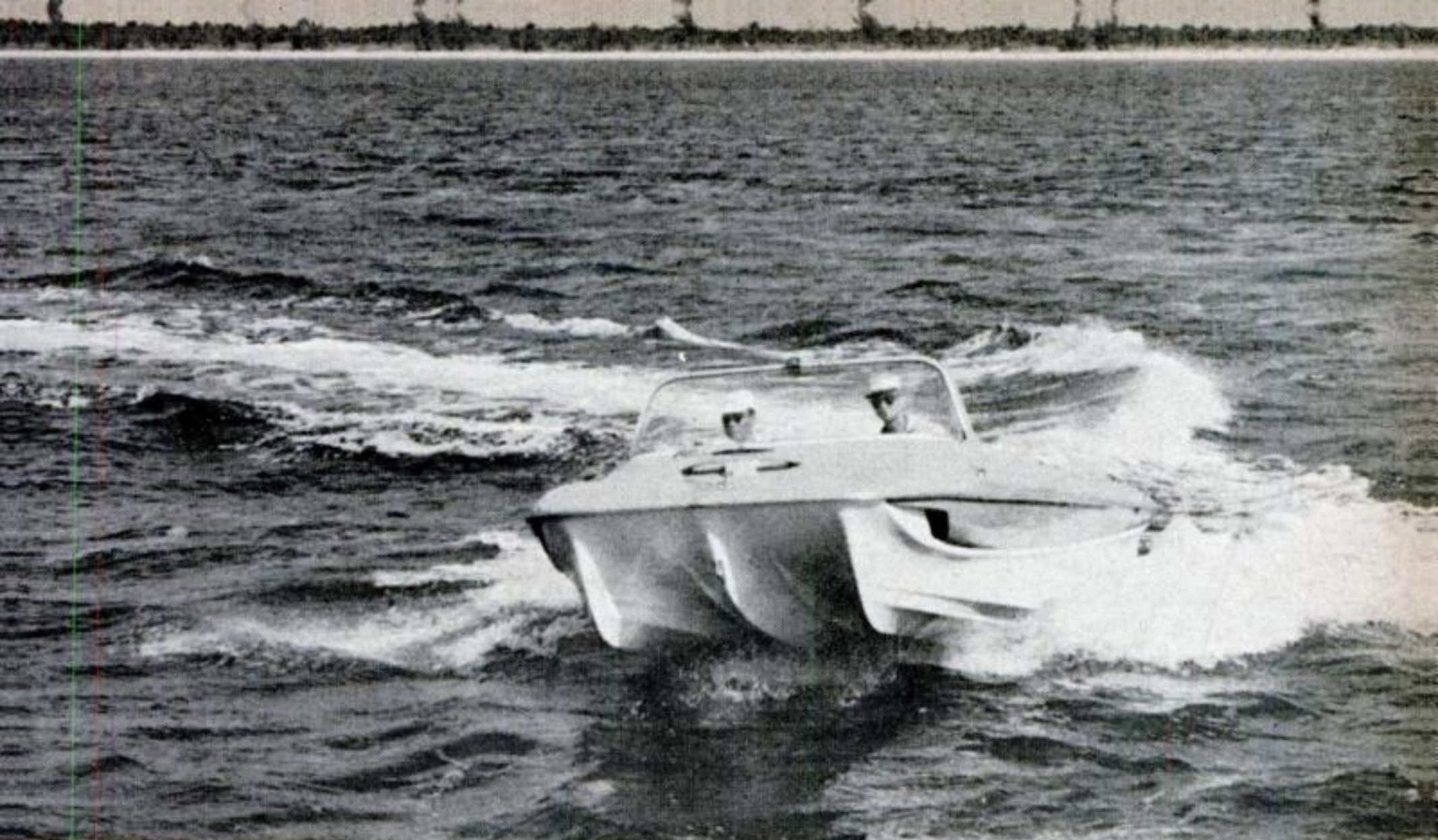
It didn't take long to get my answer. I eased forward on the single-lever control that combines gearshift and throttle. She responded instantly to the wheel as I turned to head out of the channel. With the steerable prop of the stern-drive unit, there's no rudder lag at all. I fed in a little more throttle. The bow rose very slightly—and then the stern came up. At an indicated 10 m.p.h. we were on the step and gliding over the water instead of knifing through it.

The change in attitude from displace-

After a 30-second checkout, you



GETTING CHECKED OUT on boat's operation takes little time. Approved technique calls for switching on engine-compartment exhaust blower for about 20 seconds before starting engine.



HIGH-SPEED TURNS require no special technique. The sense of security and directional stability

ment running to planing was so slight that I had trouble believing it. I chopped the gas to try again. This time I crammed on full throttle. Almost before I knew it we were skimming along at better than 30 m.p.h. There was practi-

is amazing. Maximum bank is only about 10 degrees, and sideslip is negligible.

cally no squat and very little bow rise as we accelerated.

Heading for trouble. At the insistence of my companion, Harry Ewald, manager of the boat division of Outboard Marine Corp., I pulled into the wake of our

can slip behind the wheel, fire up, and take her out feeling fully at home



SINGLE LEVER controls gearshift and throttle. Small lever at bottom of quadrant controls idle speed. It is pushed down and the shift-throttle lever set at neutral when you start 'er up.



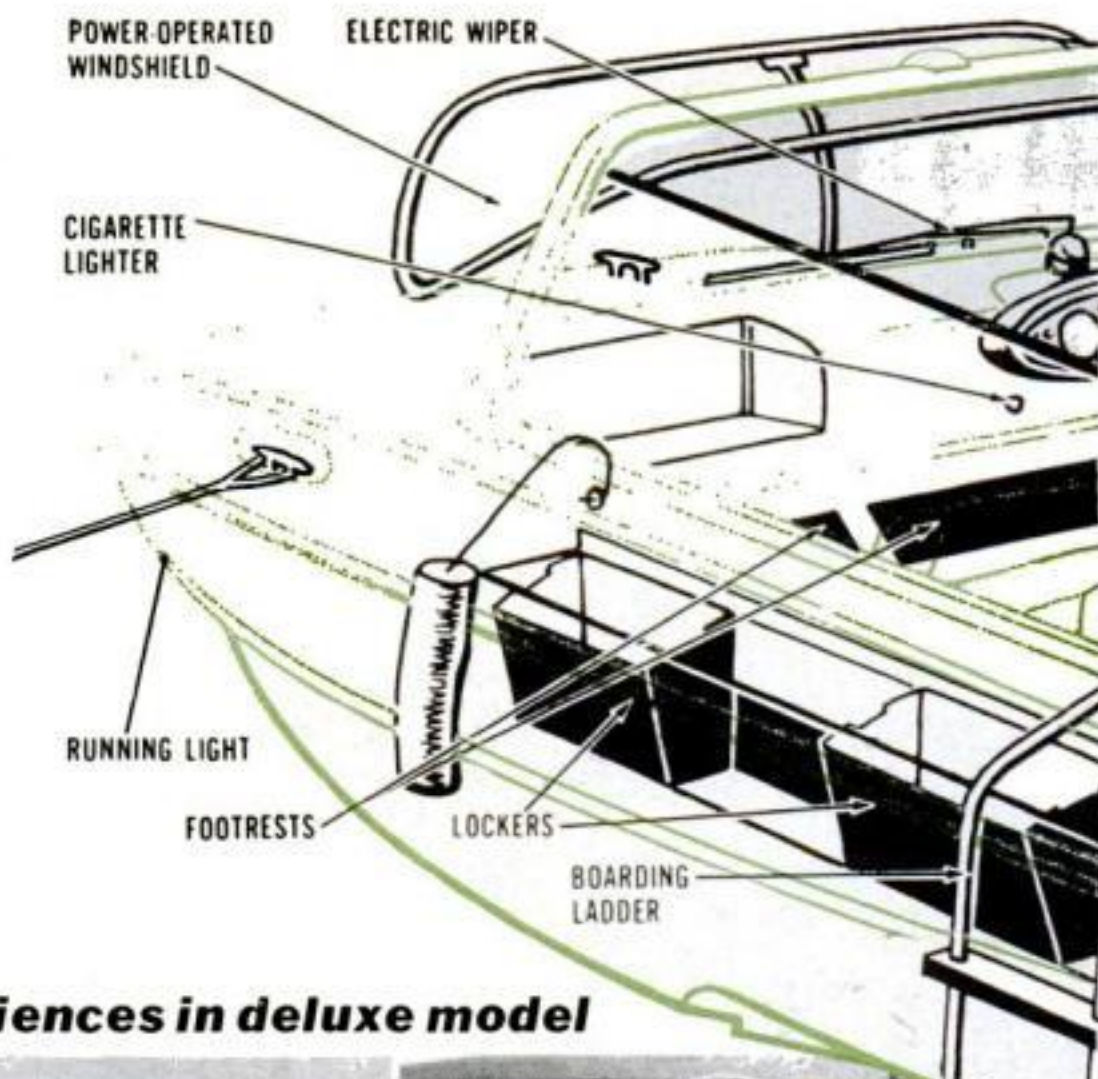
SHE'S OFF as you push the control forward all the way. Before you know it, you're skimming over the water at 30 m.p.h. Spray is thrown laterally—away from the sides of the boat.

CONTINUED

photo boat. It is not a position I would ordinarily seek in a conventional hull. Matters can get a little hairy if you frolic at high speed with a stern wave the size of the one that 25-footer with twin 75-hp. motors was kicking up. Usually, coming across the wake at a very flat angle, you get trapped for a time in the trough as if in a deep rut. When you do break out, you have to be ready with a fast correction.

But in this boat—the OMC-17 De Luxe—I could zigzag across the wake with no more fuss than angling across the trolley tracks on Main Street. Even at narrow approach angles, the triple-entry bow stepped from trough to crest as nimbly as a ballet dancer. There was no need for quick wheel correction; I just set the

CONTINUED



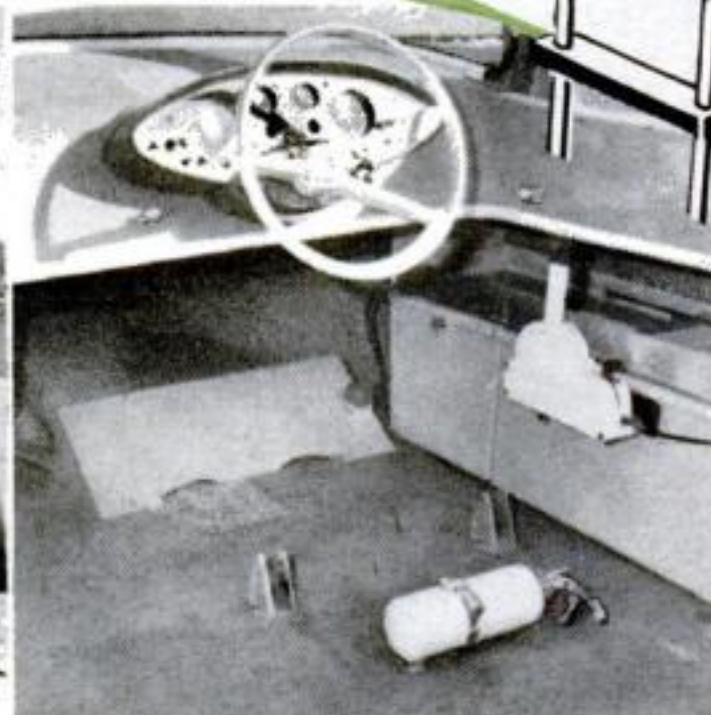
Dreamboat: Comforts and conveniences in deluxe model



LIFE PRESERVER is handy in a niche under each cushion. Cushions are vacuum-formed and heat-sealed of special foam material that is resilient but has a slow rate of rebound.



SEATS GO ASHORE for use as beach chairs. Frames are lightweight square aluminum tubing. Springs are woven rubber fabric also chosen because of its controlled rebound.

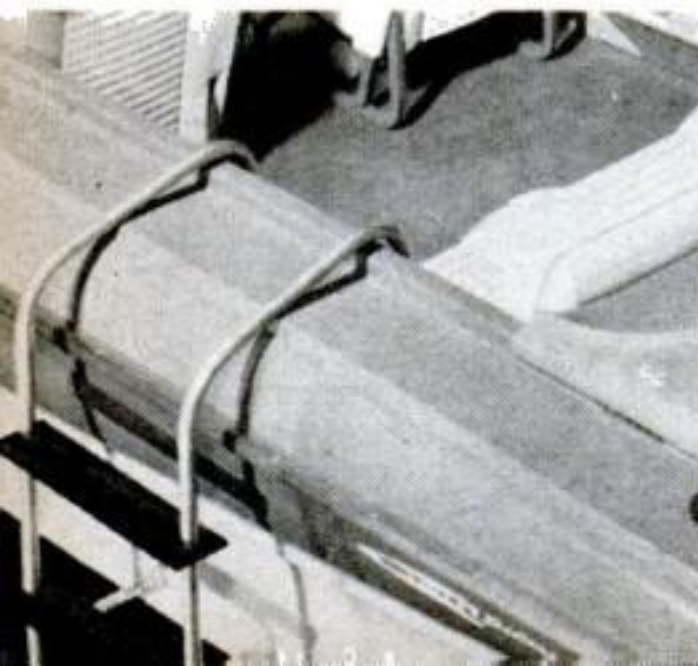


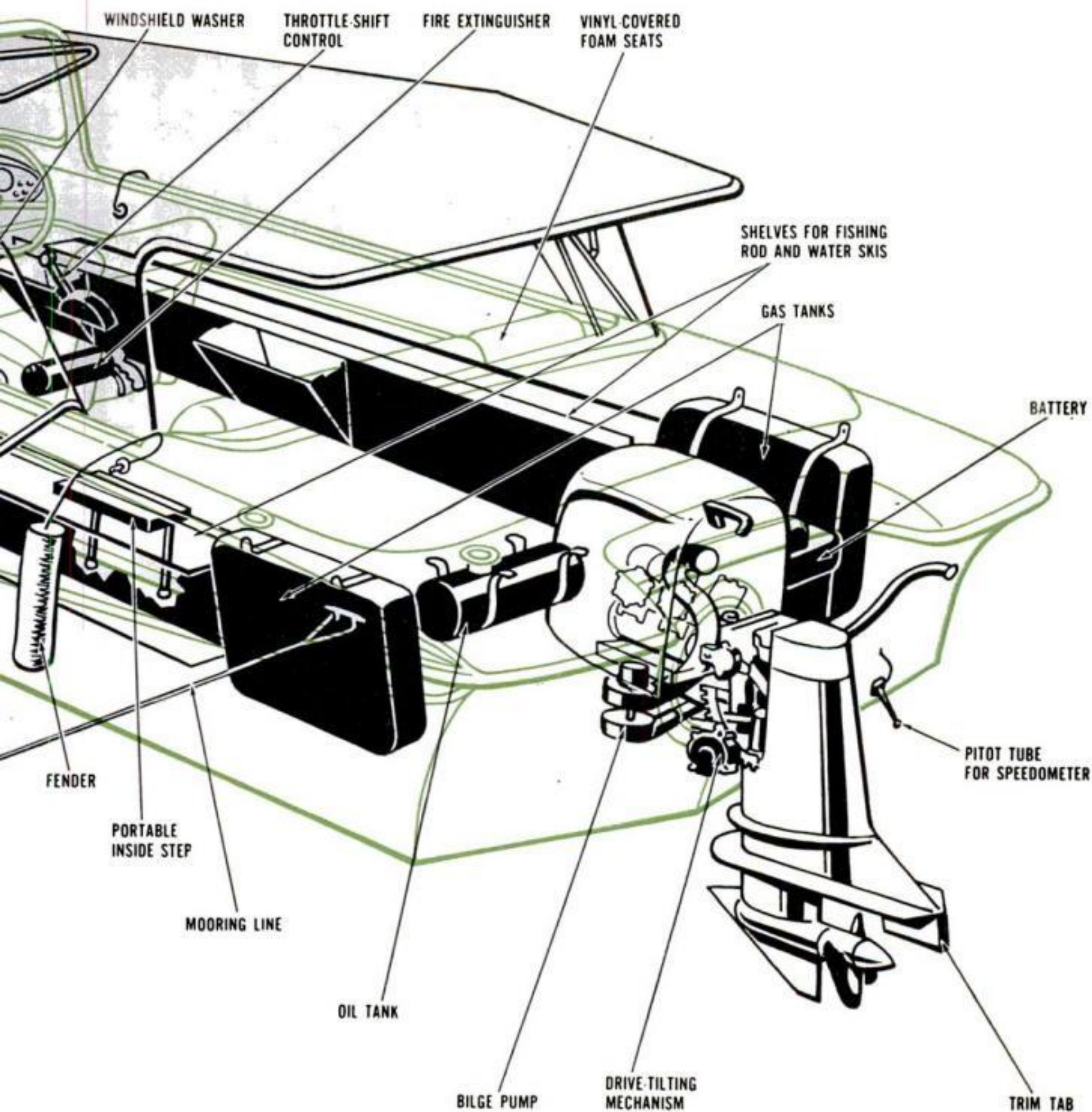
FIRE EXTINGUISHER — standard equipment—is easily reached in its mount under the driver's seat. Anchors for driver's seat can be bolted in any of three positions. Footrest is aluminum.

BOARDING LADDER hooks over side, stows under the hatch when not in use. There is also a portable step for use in the boat to make it easier for riders to step up to the gunwale.

REAR SEATS can be turned around for fishing. The hatch covers can also be removed and stowed. You get two fenders and two braided nylon tie lines with eyes already spliced in.

BUILT-IN LOCKERS include two that can be locked and two that can be insulated to make ice chests. Shelves provide a place for water skis and fishing rods. They run length of cockpit.

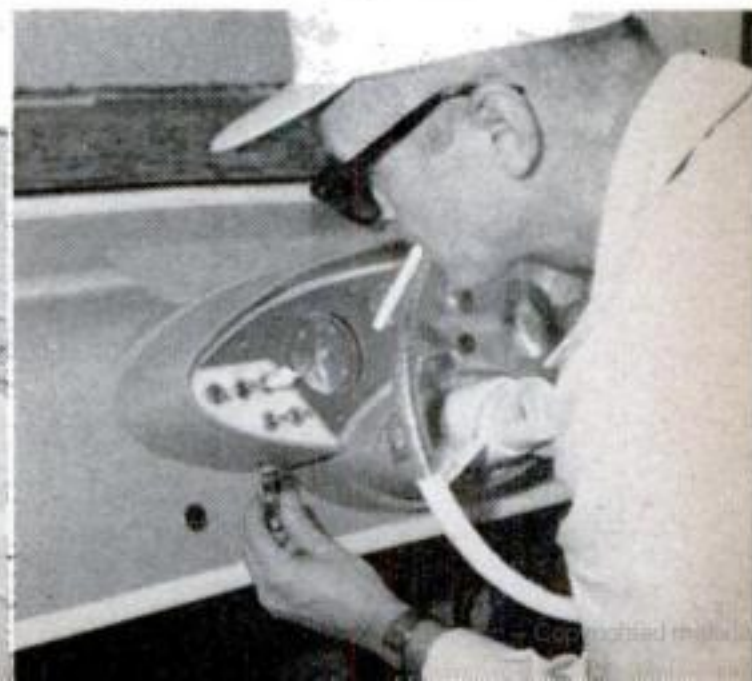
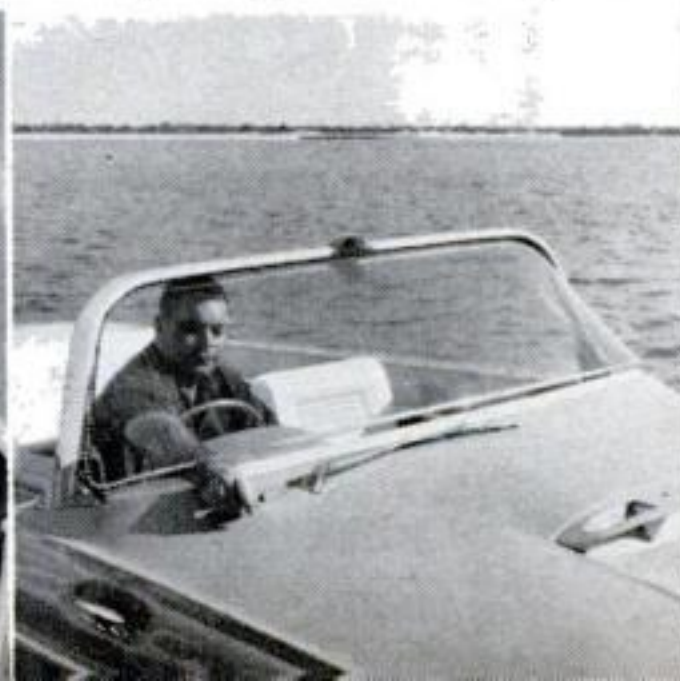
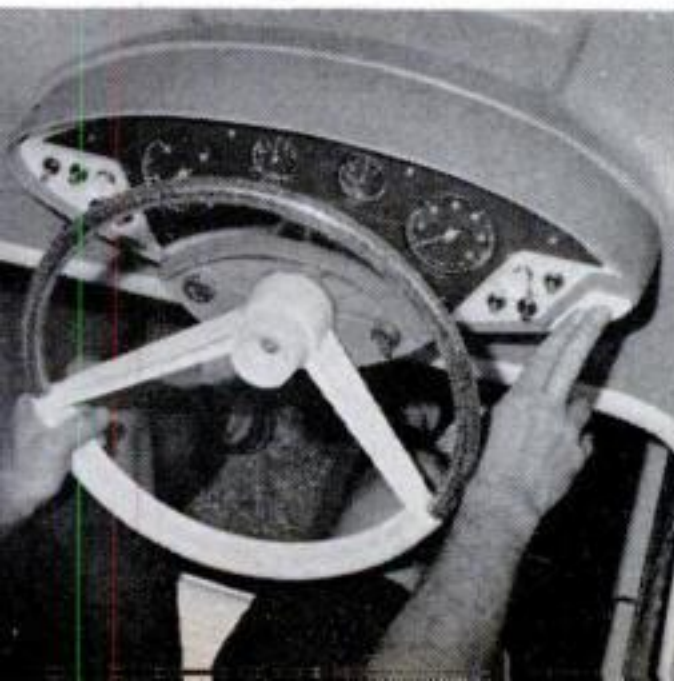




INSTRUMENT PANEL mounts a speedometer and tachometer. Fingers are touching the horn button. Switches control an elevating motor for stern-drive unit and power accessories.

POWER-OPERATED WINDSHIELD tilts at touch of a button. If it hits obstruction on closing, it shuts off automatically. Windshield wiper is powered by electricity. It parks off the glass.

NOTHING'S OVERLOOKED for convenience — there's even a cigarette lighter. Rudder-position indicator shows angle of lower drive unit to prevent heading wrong way at start.



Dreamboat: Shrewd design shows up in hull and power plant

course I wanted, held it steady, and the boat did the rest.

As we neared the Gulf, I noticed a sandy beach near the channel entrance. "How is she for beaching?" I asked Ewald.

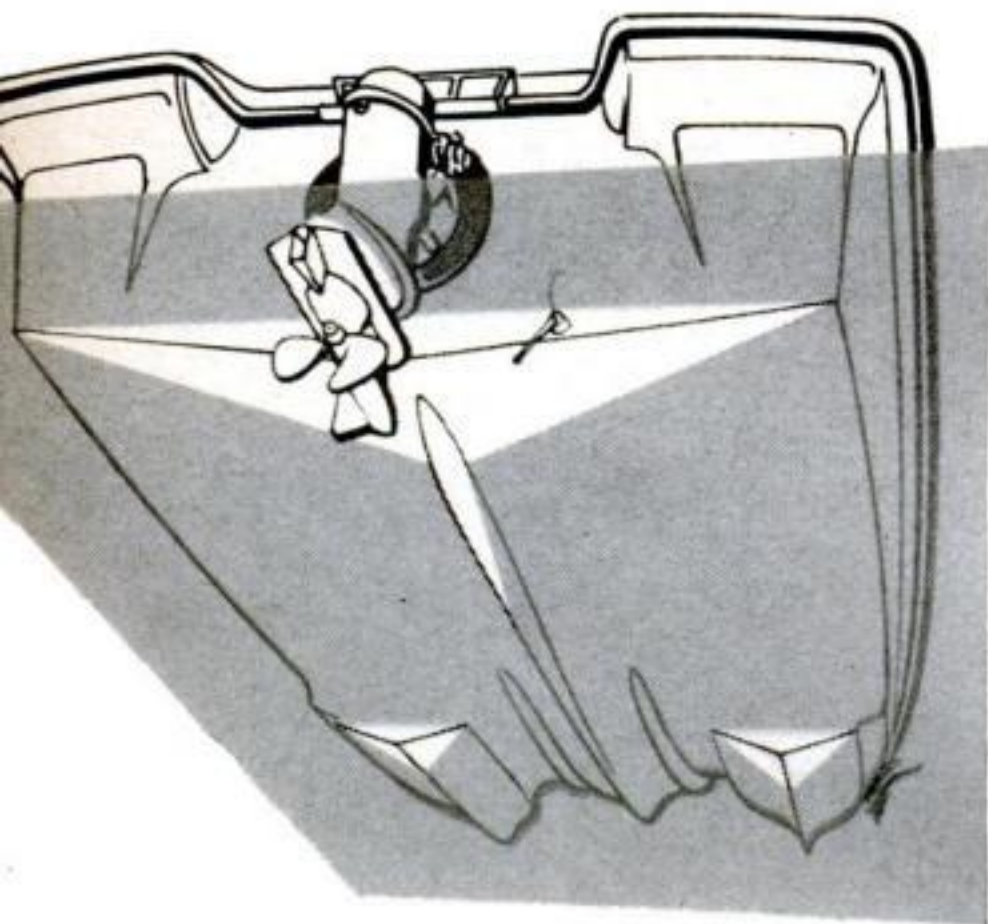
"Like nothing you've tried before. Be my guest," he said, with a sweep of his hand toward shore.

I cut back the throttle and nosed in.

"Forget all you know about beaching," he went on. "Don't worry about wind or current. Just drive into the sand as if you were driving your car onto a grease rack."

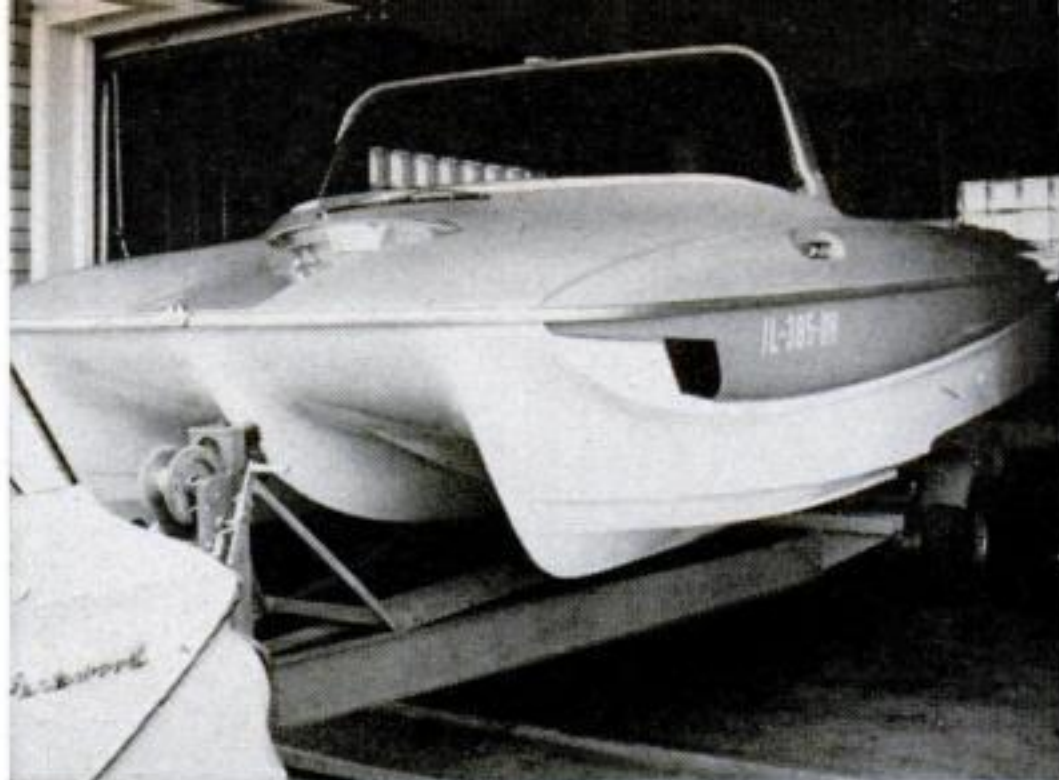
Parking's a breeze. The right front wheel—oops, the starboard sponson—nuzzled into the sand. Automatically the boat swung around until it was square to the shore line. I revved up the engine for an instant and the bow climbed out high and dry. The boat was rock-steady.

[Continued on page 208]

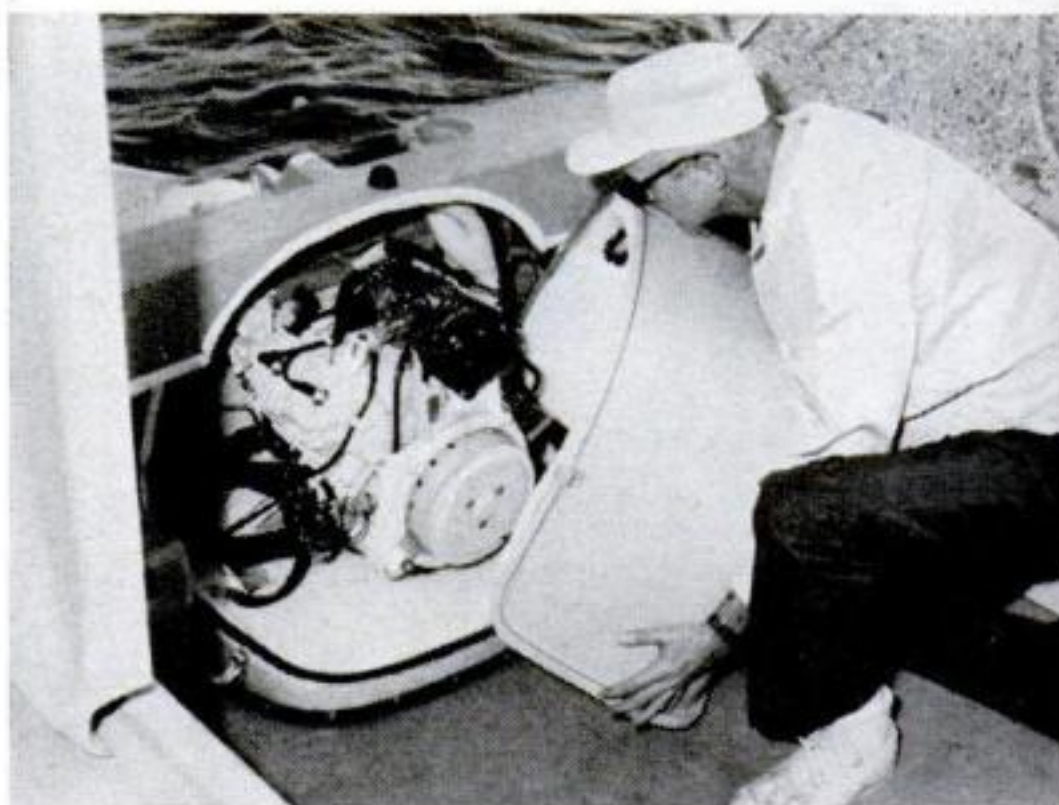


She planes on three points

THREE-POINT HULL means that the boat rides on three dart-shaped surfaces at planing speeds. Force of water against these surfaces lifts the boat out so that it skims along the surface. Two support points forward on the hull give the boat the wide-tread stability of a car.

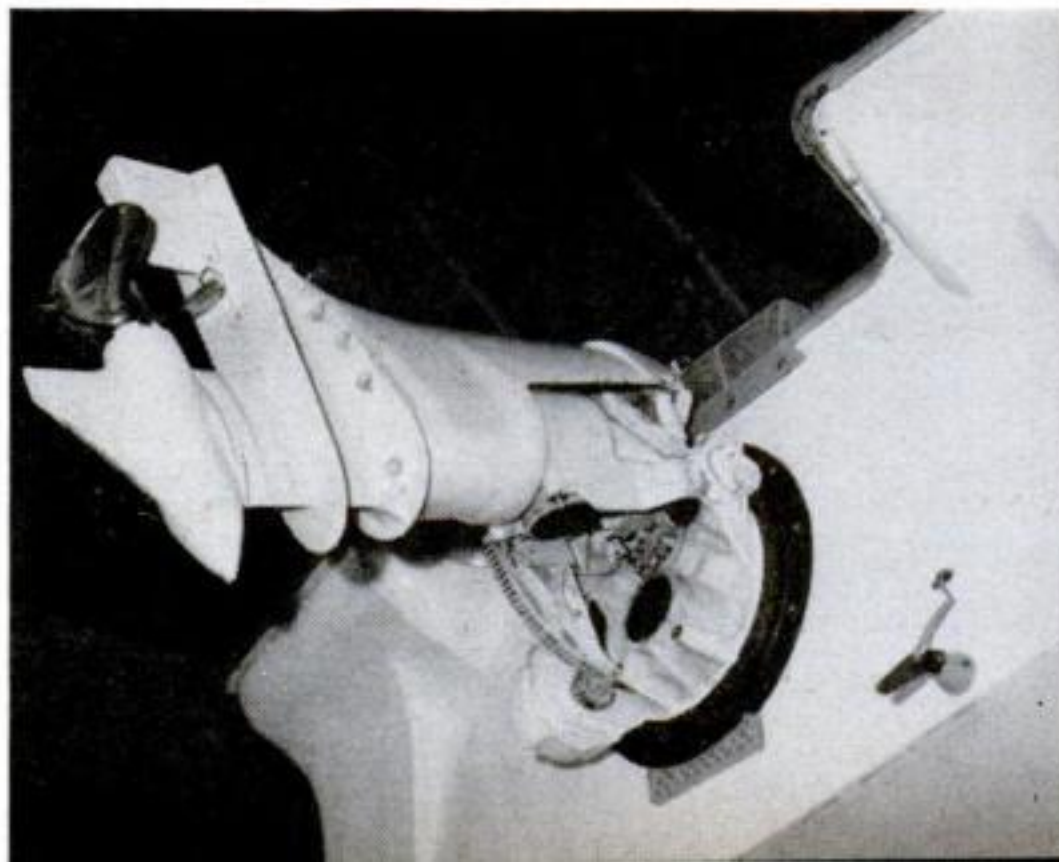


SPECIALLY DESIGNED TRAILER is available for \$675. It's complete with winch and inertia-actuated electric brakes. Boat and trailer will fit comfortably in the average garage.



ENGINE IS COVERED with sound absorbing, water-tight cover. Breathing air comes through a grille high on the transom. Fumes can be exhausted from compartment by a built-in blower.

DRIVE UNIT TILTED UP shows powered elevating rack-and-pinion and ball gears that transmit power from engine. Cooling water is fed from pump in lower unit through pivot journal.

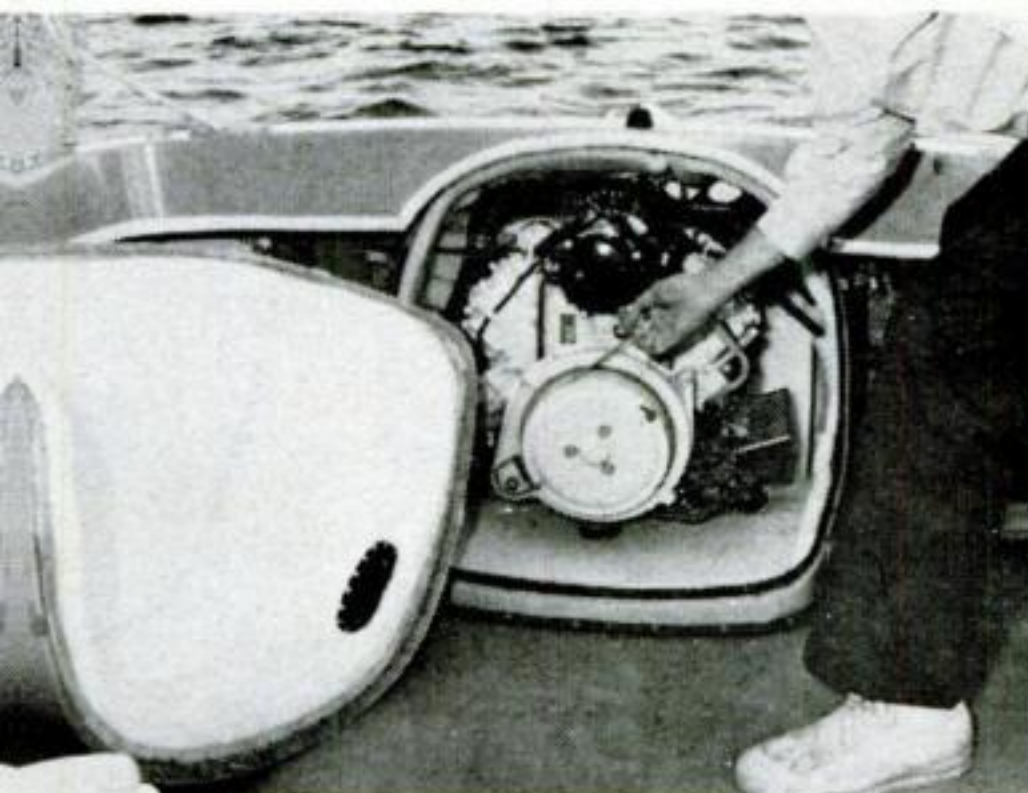




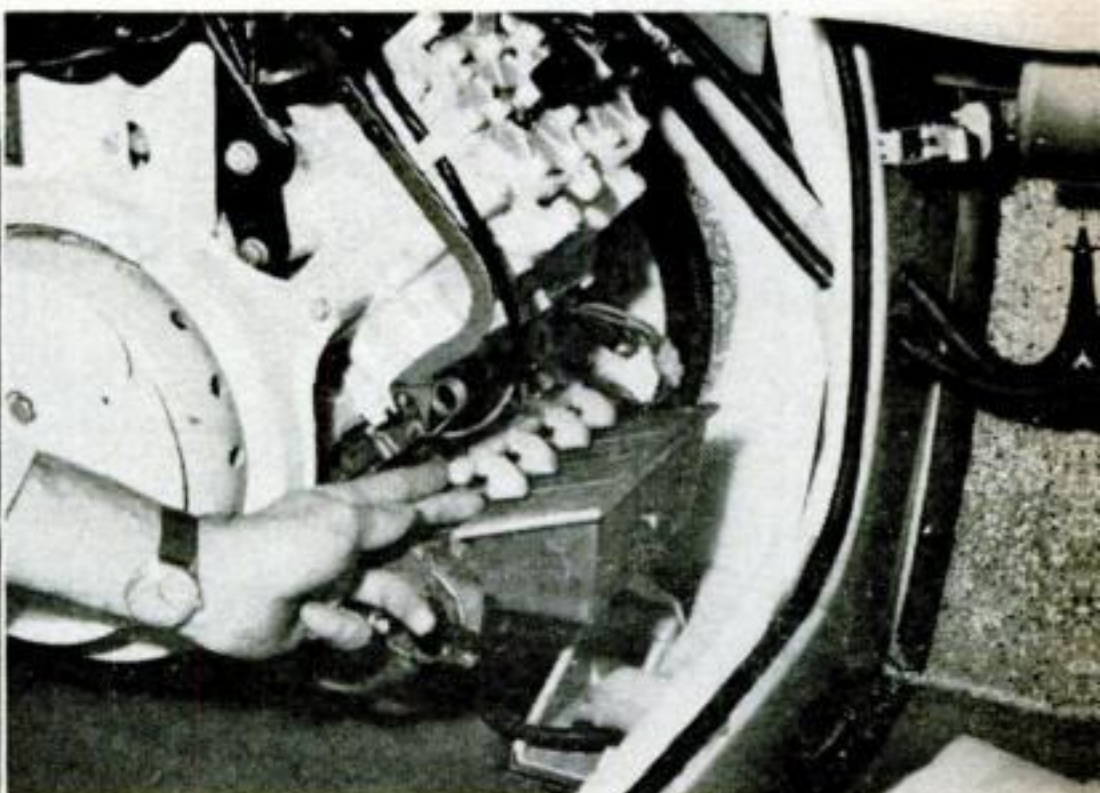
THREE MEN ON A BOAT demonstrate its amazing stability. You can be completely carefree about where you step and how you load—nothing seems to disturb the boat's trim seriously.



BEACHING IS A CINCH anywhere you have water enough to wet the prop. Head in at any old angle and she automatically squares up to the shore line, stays level and rock-steady.



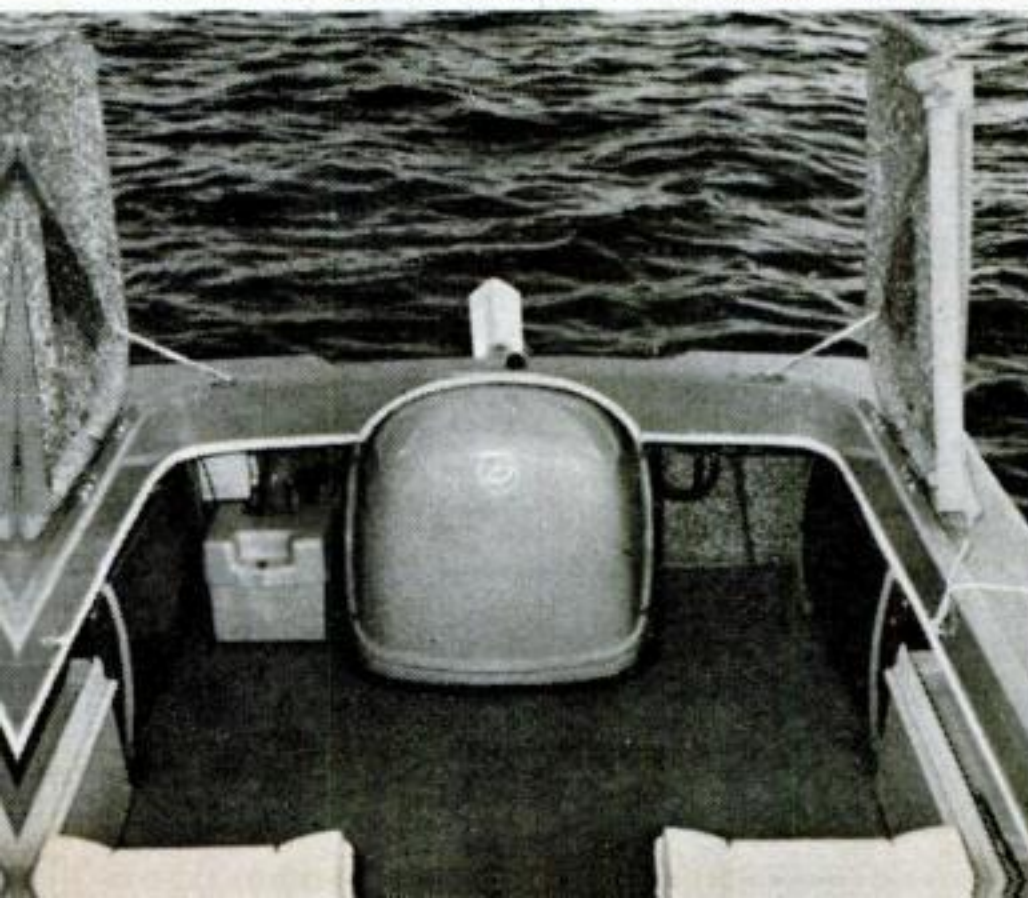
EMERGENCY-STARTING ROPE is carried on a cleat inside the cover. Engine is 90-cu. in., two-cycle V-4, developing 80 hp. at 4,500 r.p.m. It's water cooled, and weighs only 146 pounds.



OIL IS NOT MIXED WITH THE GAS: A metering pump delivers a squirt of oil to each cylinder once every 20 revolutions. Hand here is adjusting ganged jets on four-barrel carburetor.

VIEW AFT shows 18-gal. fuel tanks on either side. Covered battery box, manual priming pump, and electrical junction box are on the starboard side of the engine; oil reservoir is on the port.

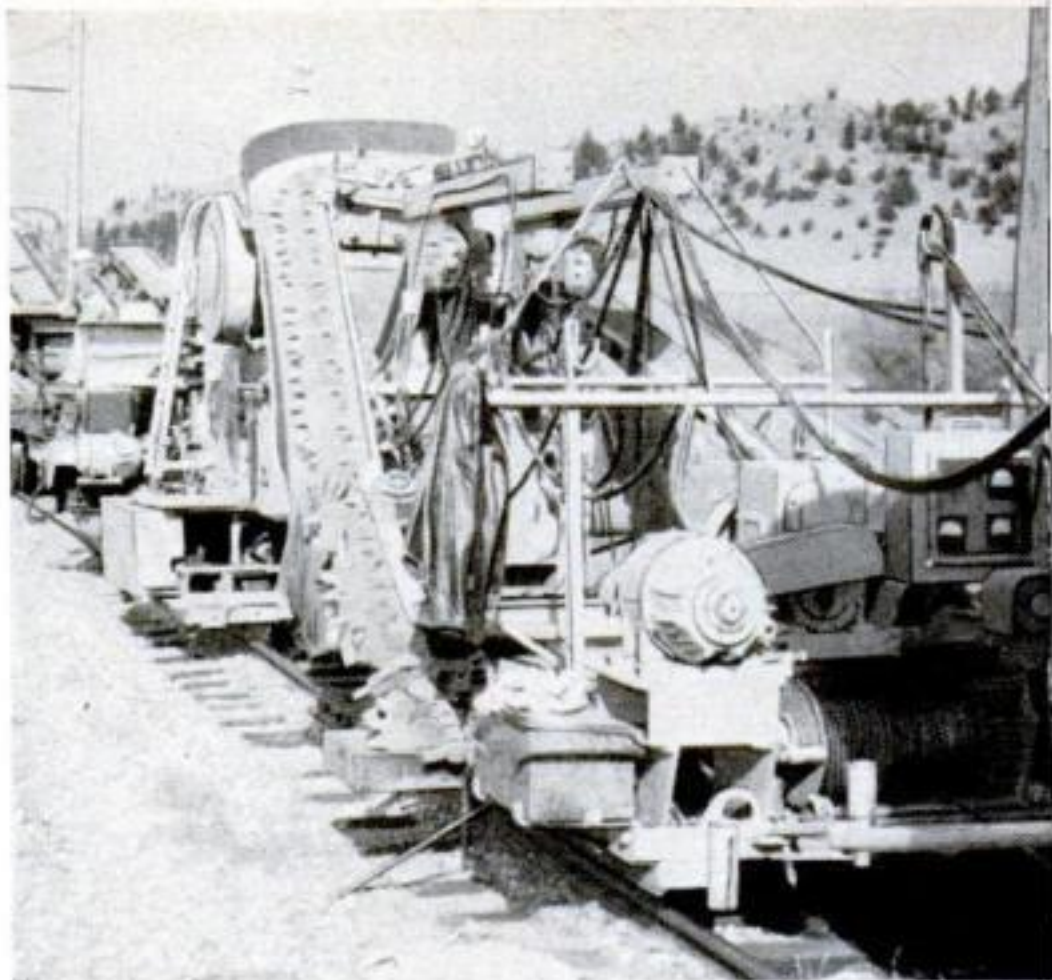
MAINTENANCE? Most of it on this boat can be done with a garden hose. Bilge pump (note discharge by stern) keeps up with wash water. Everything in the boat can be hosed clean.



Fitting tunnels to bigger freight trains

To take big triple-deck automobile flat-cars, massive transformers, turbines, and other outsize loads going from Chicago to the Pacific Northwest, 31 tunnels along 706 miles of railroad track had to be enlarged—floors lowered, walls pushed back. Five mountain ranges were involved—in Montana, Idaho, and Washington—and the job took six months.

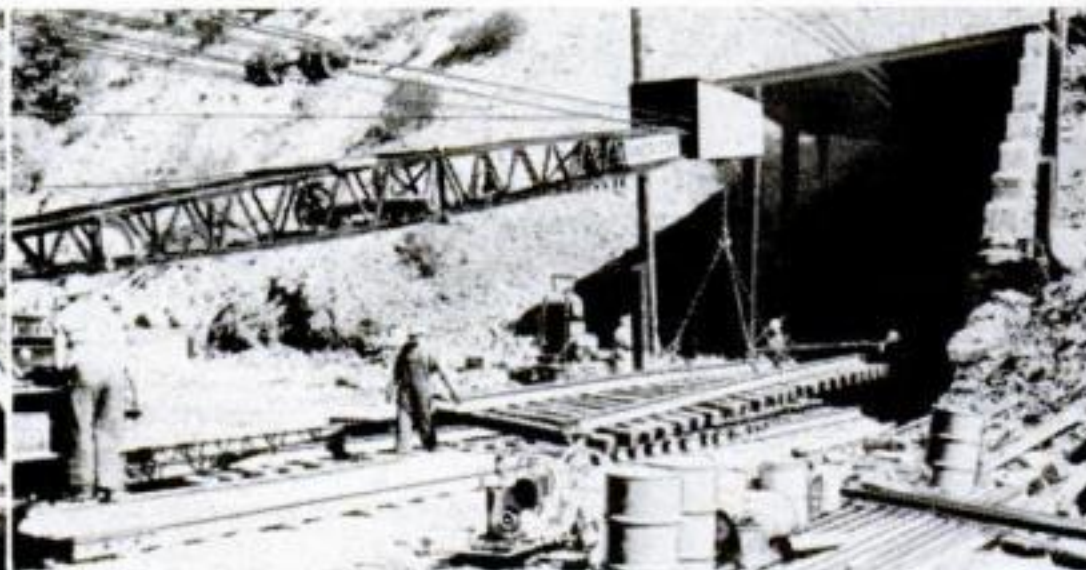
Trains on the Chicago, Milwaukee, St. Paul & Pacific maintained schedule while the work was in progress. A total of 71½ miles of track was lowered from 6 to 24 inches, 4½ miles actually in tunnels, the rest at approaches. The work cost more than \$800,000.



1. MATISA UNDERCUTTER is driven by electric motors getting power from diesel generators mounted on small track car ahead. Machine is adapted from a Swiss-built tunnel excavator.



3. SYSTEM OF CONVEYORS on train of dump cars hauled behind undercutter machine loads rear car first, then ones ahead of it. Using undercutter avoids need for removing track.



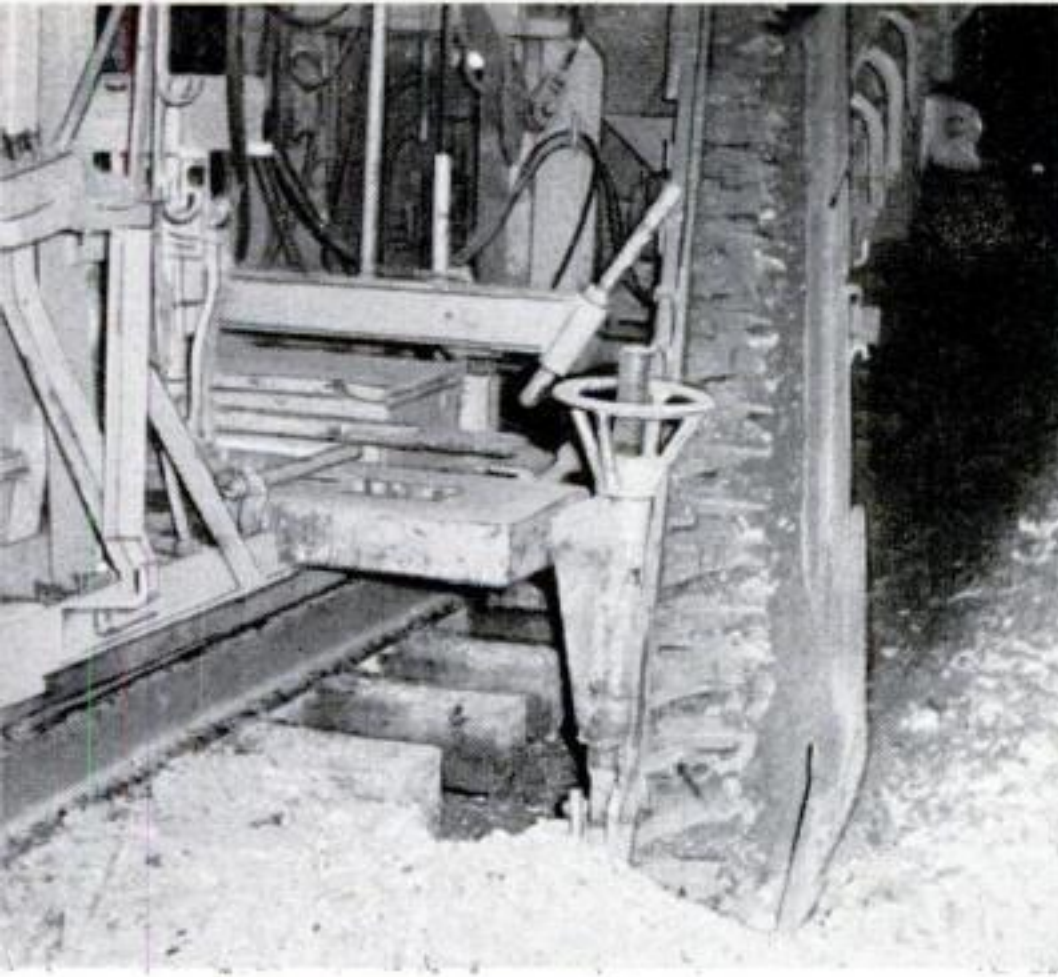
4. ALTERNATIVE METHOD (without undercutter) requires taking out track in 39-foot sections. Here a heavy-duty crane backs out with an entire panel: rails with ties still spiked on.



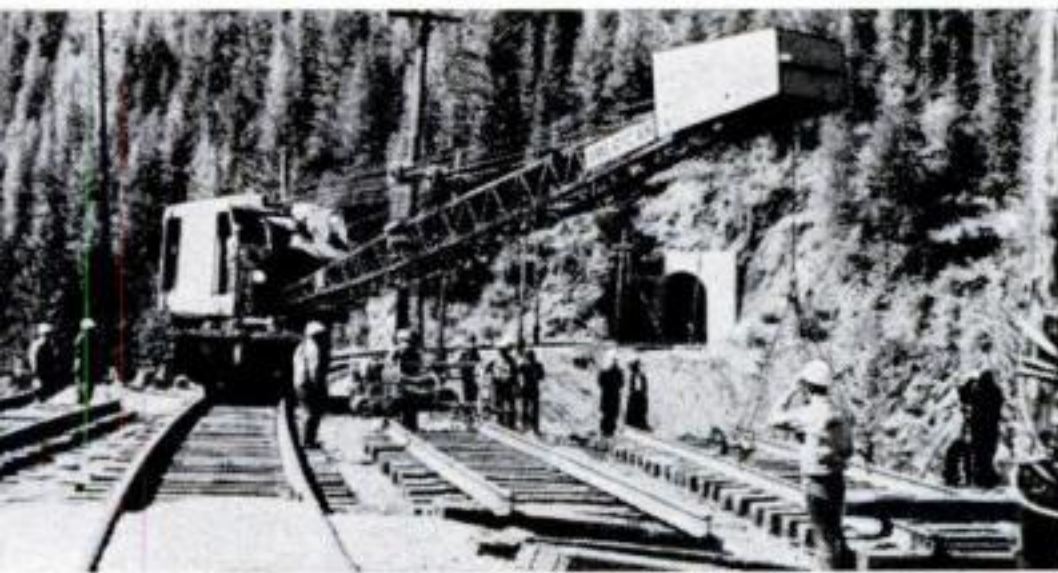
6. BULLDOZERS PUSH OUT blasted and ripped-out rubble, dumping excess material over embankment at tunnel's end. Roadbeds were lowered 6 to 24 inches to increase clearance.



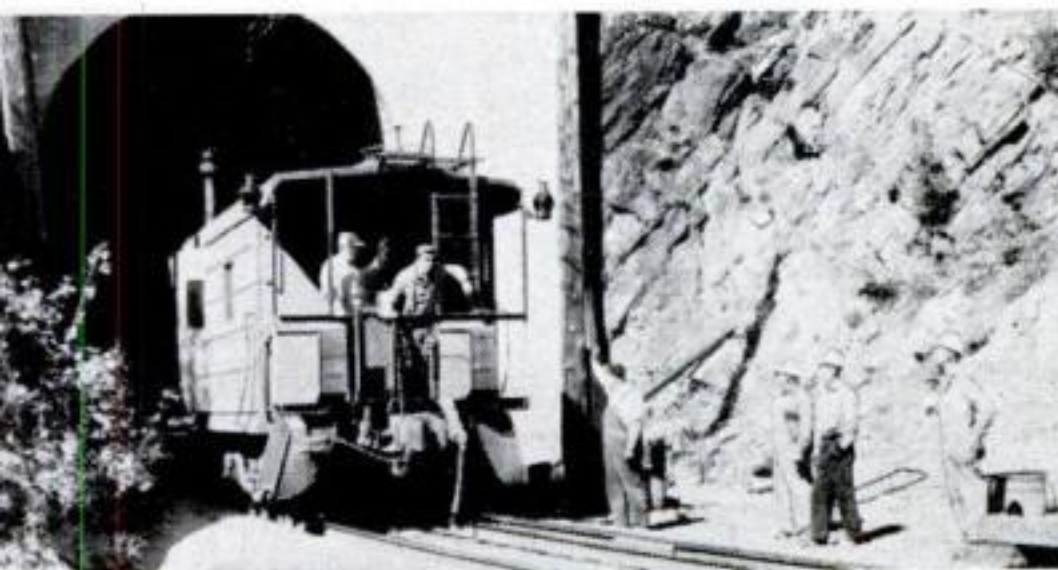
7. WORKMEN STRIP RAILS from ties while bulldozer clears out rubble. Rails and tie plates are attached in panels to new ties with new spikes before being relaid in tunnel.



2. ENDLESS CUTTING CHAIN digs under ties at right angle to rails. As winch pulls machine forward, chain moves dirt and rock into a bin and onto conveyor. Maximum cut is 12 inches.



5. PANELS ARE NEXT STACKED outside tunnel where they can be replaced quickly when dispatcher warns work crews by radio to make ready for approaching train to pass through.



8. BREATHER is taken by work crew after temporary replacement of track to let freight train pass. Cranes then lift rail panels out again and lowering of tunnel floor is resumed.



Continental kart

Now comes the Ghia Kart, latest and most elegant of all racing karts. Its sleek body was designed by Ghia of Turin, famous Italian automobile stylists. The smart little body will take any kart engine. It complies with all kart-track regulations.



Squared-off helicopter

A new light helicopter, shaped like a box, is a six-place utility craft designed for Navy fleet use, Marine assault support, and civilian passenger service. The Hiller Ten99 is powered by a 500-hp. Canadian Pratt & Whitney PT6 turbine engine. It loads and unloads quickly through aft clamshell doors and four doors in the sides.

Will Tomorrow's Cars Burn Kerosene?

New engines on the way indicate that they will—or some other cheap fuel—with a bonus of 50-percent gain in gas mileage

By Harland Manchester

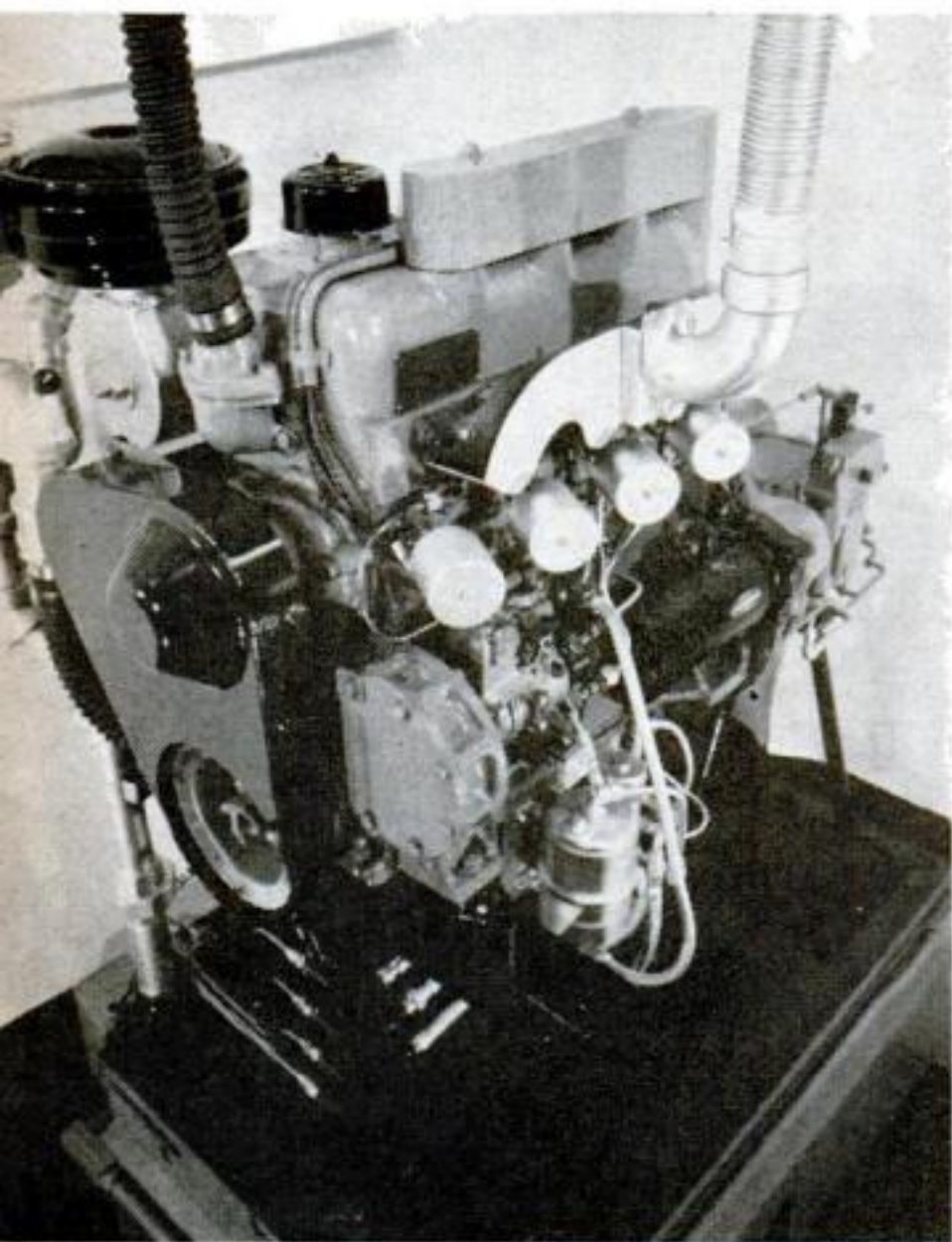
THE 12-year-old black Plymouth sedan in which I was riding rolled into a filling station recently, and the driver, Charles W. Davis of the Texaco Research Center, at Beacon, N. Y., asked for two gallons of "regular." Then he opened the trunk, brought out a two-gallon can of kerosene, and poured that in the tank. He ordered a quart of lube oil, and when the man started for the engine, he told him to put the oil in the fuel tank, too. Muttering "Now I've seen everything," the man complied.

By all ordinary rules, that engine should have knocked violently when we drove out, but it behaved like any other motor of its vintage. Except for one thing, as I learned later—it got a lot more miles to the gallon out of the bizarre mixture than other motors do from high-test gasoline.

The engine in this car was designed by Texaco. "It will burn almost any fuel," Mr. Davis explained to me. "We don't usually mix them up this way, but I thought it would be a good way to demonstrate its omnivorous appetite. We have driven it about 40,000 miles all over the country under all sorts of conditions. We have filled the tank with high-test gasoline, diesel fuel, jet-plane fuel, and kerosene, to name a few common fuels, and with a few changes it would do as well on propane cooking

gas. We have averaged 24 miles to the gallon, but we've got a new engine in the laboratory which should do about 34, according to tests. We are not going into the automobile business, but everything about motor fuel interests us. We have spent \$1,000,000 and 15 years developing and testing this engine, and we think it has a future."

TCP in Ford's future? This is one of several new engines now being developed here and abroad that will burn a wide variety of petroleum fuels, and whose builders promise many advantages. They have aroused great interest and controversy among the world's automotive experts, and most major manufacturers are testing one or all of them



TCP engine is not choosy about what it drinks. High- or low-octane gas, diesel fuel, kerosene—it makes no difference. Newest model soon will be tried out in a Ford.

with a weather eye to the future. The Ford Motor Company, under a recent contract with Texaco, will soon mount the latest TCP (Texaco Combustion Process) engine in a new Ford to compare its performance with Ford's regular motor. This doesn't necessarily mean that tomorrow's Ford will burn kerosene. It does mean that Ford is keenly interested in the TCP, and is going to spend some time and money developing it.

Back of this whole research trend into motors with democratic tastes lies a lot of automotive history and a number of new factors. Briefly, gasoline-engine performance has been increased for the last 35 years by increasing the compression ratio—that is, by sending the piston farther toward the top of the cylinder and squeezing the fuel mixture into smaller and smaller volume, so that when it burns it expands more, driving the piston down with a more powerful punch.

But the tighter you squeeze the fuel charge, the more finicky the engine's appetite becomes—hence the long, costly refining program to increase the fuel's octane number, which means its index of compressibility without knocking. Every time the gasoline in the nation's pumps goes up the scale by a single octane, it costs refiners an estimated \$500,000,000 in equipment. This charge is passed on to drivers, who get more power and speed for their money. But now, everyone concedes, this race between motors and fuels has gone as far as it can go.

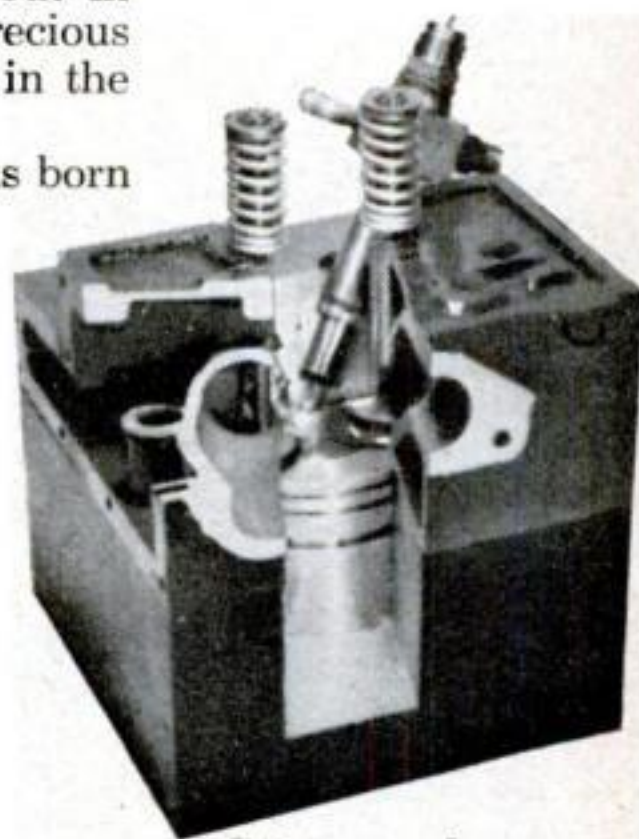
Meanwhile, production of kerosene is booming as the jet airliners take over the skies. Today, about 47 percent of a barrel of crude oil is converted into motor gasoline. About 75 percent of that barrel can be made into fuel suitable for the TCP engine at a much lower cost per gallon. If any one of several of the new omnivorous engines win out in the market place, it may no longer pay to brew precious costly fuels, and kerosene and its humble neighbors in the oil barrel may fuel virtually all our engines.

Fitting the engine to the fuel. The TCP engine was born in the late Forties when Everett M. Barber, a Texaco research engineer, was trying to find a cheaper substitute for tetraethyl lead, an additive long used to boost the octane number of gasoline. Then he got an idea for rebuilding the top of the engine so that it wouldn't need high octanes. He built his idea into a crude one-cylinder engine, and it worked. In 1950 he showed me in his laboratory a little engine which he switched over from 100-octane gasoline to kerosene with no change in behavior. Since then Texaco Research has built several multicylinder TCP engines that have been successfully operated in a number of vehicles. The newest of these will be installed in the experimental Ford in a few months.

Below the combustion chamber, the TCP engine is like any other, but the fuel is burned quite differently. In today's engine, a charge of vaporized fuel—premixed in the carburetor—is pulled into the engine, compressed, and ignited by the spark, and the flame front spreads across the chamber. Unless the fuel matches the engine, the most distant part of the charge will ignite prematurely, causing



Swirling-air principle of TCP engine is shown in cutaway at top of hemispherical combustion chamber. Below it is elevation view of the chamber.



Cutaway shows Texaco cup combustion chamber, another version. Here, too, spark plug and fuel spray are located close together.

Cheap fuels are already here, awaiting passenger-car

knock. In the TCP engine, the fuel is delivered to the flame as fast as it will burn, and no unburned residue has time to set up a disturbance. It works this way: First the piston pulls in a charge of pure air through a shaped duct that gives it a fast, circular swirl around the chamber. The piston compresses the swirling air; then the charge of fuel

is shot in through an injector. This "paints the air with fuel as it goes by," as Davis puts it. The spark plug, a little "downstream" from the entering fuel, touches it off. In effect, the air stream acts like a conveyor belt, delivering the fuel to the flame front. Since the fuel mixture is richer at the point of entrance, it ignites fast and helps to burn the thinner mixture down the line. It's

a little like using kerosene to start a wood fire. All this makes it possible not only to burn cheap fuels, but to use a much thinner overall mixture, which means more miles per gallon.

Everyone's in the act. Work on other "stratified-charge" engines, as engineers call this type, is going on in many laboratories. The Russians are working on one at the Institute of Chemical Physics at Moscow, another is being tested at the French Petroleum Institute, others by Renault Motors, and by engineers at the University of Rochester and Pennsylvania State University. They vary widely, but all are aimed at the goal of burning cheap fuels by "prim-

ing" an economical, lean fuel-air mixture with a bit of richer stuff. Most of these motors are still one-cylinder laboratory devices, and it is generally conceded that the Texaco venture leads the field.

The man at Ford who will supervise the TCP tests is the alert, hard-headed Victor G. Raviolo, executive director of the engineering staff. Last spring he attracted wide attention with his statement at a meeting of the American Petroleum Institute: "The stratified-charge engine is a most promising development for passenger-car engines. Potential fuel economy is projected for certain of these arrangements at more than a 50-percent improvement in miles per gallon. I do not now expect that the development of such engines can be brought along fast

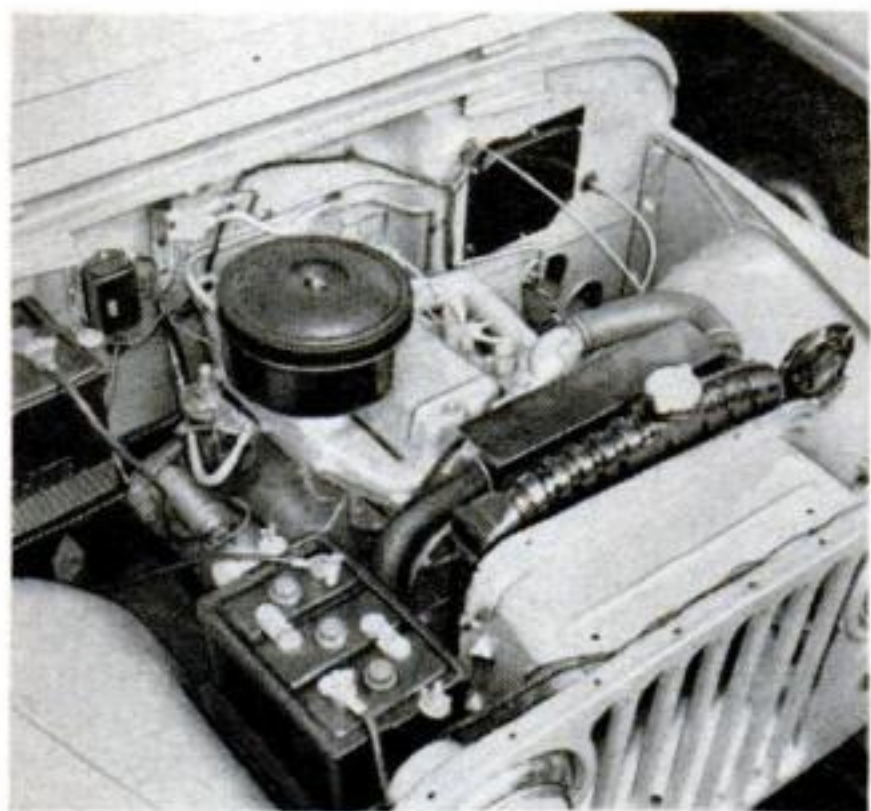
enough to be introduced in the mid-60s. However, a number of manufacturers will pursue this development aggressively and someone will succeed before the end of the decade."

Ford also has a kerosene-burning engine up its sleeve, says Raviolo, but he will not describe it.

The pinwheel engine. Another contender, which thrives on kerosene or almost any fuel, is the automotive gas turbine. Important steps have been made recently in solving



TCP engine in this 12-year-old Plymouth has been driven 40,000 miles, averaging 24 miles a gallon—using all kinds of fuel. Texaco has spent \$1,000,000 over 15 years developing it.



The diesel—now in passenger-car use—burns kerosene-like fuel. The British Perkins, in jeep above, is mounted in many U. S. taxis. Claim is doubled fuel mileage.

engines that will burn them efficiently

problems that once plagued it. Several years ago this "pin-wheel" engine, a cousin of the airplane jet, stirred up world-wide interest when several manufacturers here and abroad tested their versions on the highways.

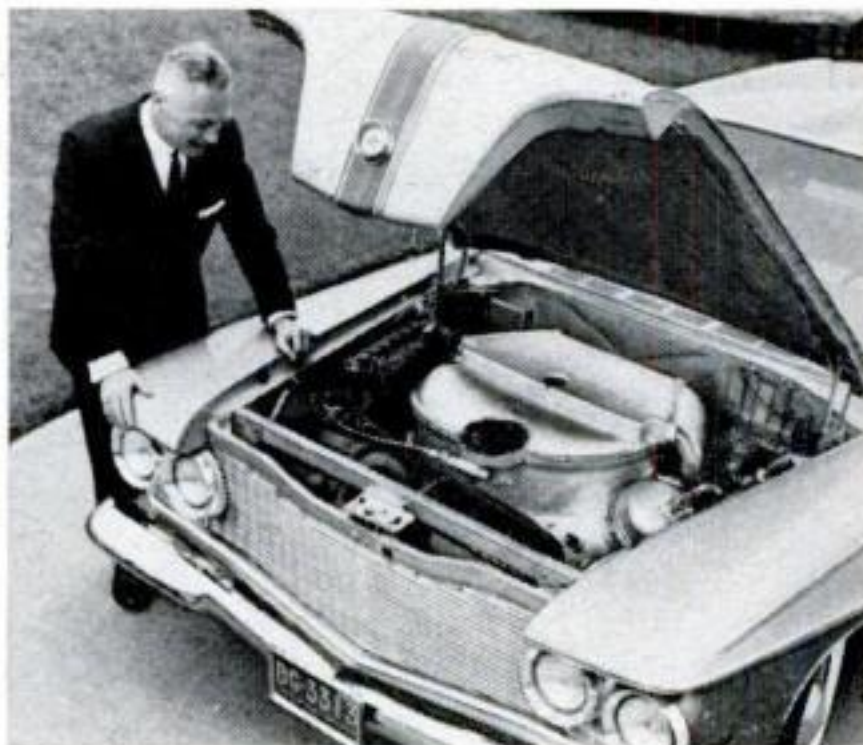
Basically simple, the gas turbine has a whirling compressor in front that pulls in air, squeezes it into small volume, and pipes it into a combustion chamber where it combines with fuel and burns to create a fiery tornado. The expanding gas shoots across a small air gap to drive a second turbine, which is geared down to drive the wheels of the car.

Among the gas turbine's advantages: It is about half the weight of a piston engine of equal power output, has only one-fifth as many moving parts as today's engine, is miserly with lube oil, and should have long life and easy maintenance. It needs no radiator or cooling system, so there is nothing to freeze. It starts well in cold weather. It has its own built-in automatic transmission, so it needs no clutch or gear shift. It needs only one spark plug, used to start the fire. It hardly vibrates at all.

In the early Fifties this engine seemed the answer to the motorist's prayer. Then problems arose that seemed insoluble: The engine was dangerously slow in acceleration; the little seven-inch drive turbine had to be made of such a precious alloy to withstand the intense heat that this item alone might cost more than an entire piston engine.

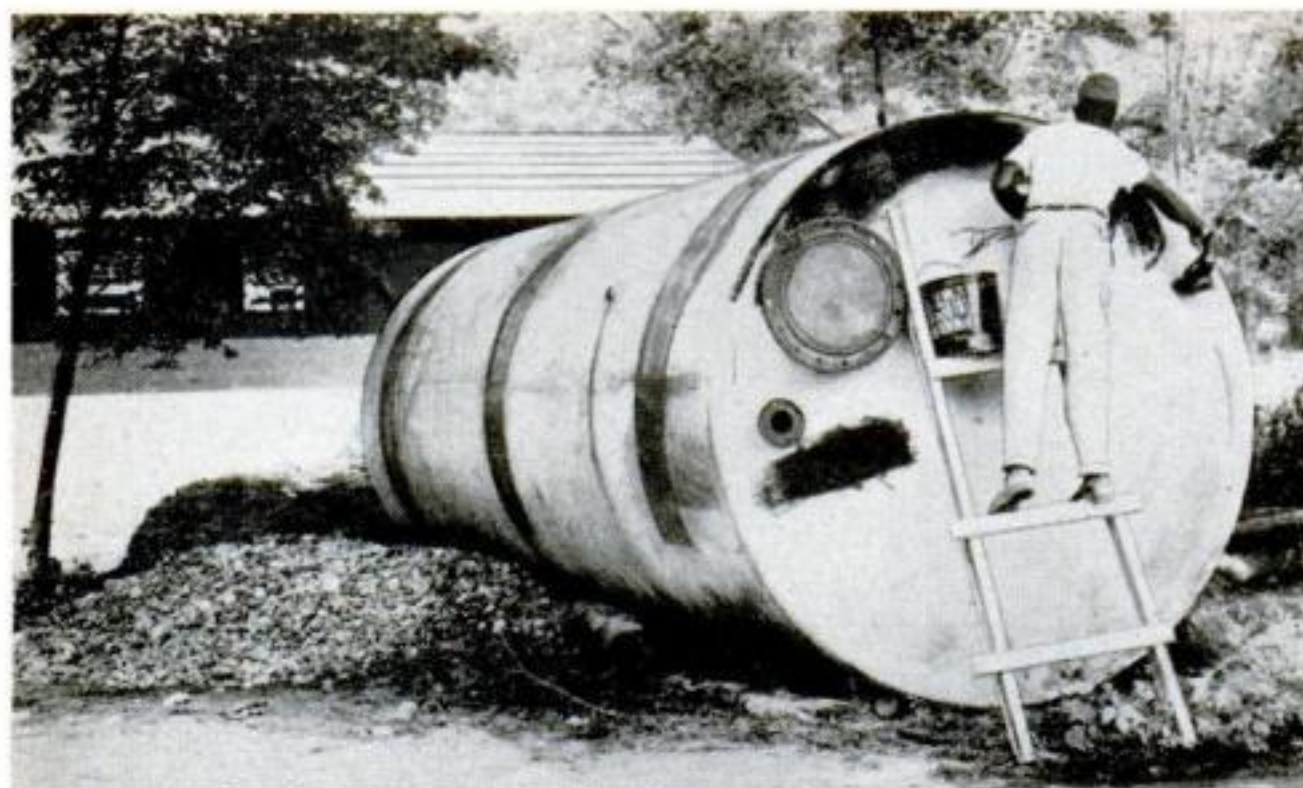
These drawbacks dampened the zeal of several early gas-turbine designers and their engines went on the shelf. But George J. Huebner Jr., executive engineer of Chrysler's research division and the designer of the firm's experimental gas-turbine automobile, remained stubbornly dedicated to the pinwheel engine, and after several years' work has devised ingenious improvements that go far to correct the troubles.

Controlling a tornado. To get more turning power at low engine speeds, beef up acceleration, and assist braking, he has installed a device in the air gap that behaves something like a variable-pitch airplane propeller. Its 23 small blades automatically change their angles through a range of 100 degrees, controlling the hot-gas tornado and varying the power delivered to the wheels according to driving demands. In the first gas-turbine cars it took about five seconds to get results when you pushed down the gas pedal; in Chrysler's newest model the apparent time lag has been cut to about seven-tenths of a second, which is in the range of today's cars. And when the angle of the blades is reversed, the direction of the blast slows down the power turbine, causing a braking effect similar to what today's driver gets when he takes his foot off the pedal. This device is powered by the same hydraulic system that runs the power steering and braking.

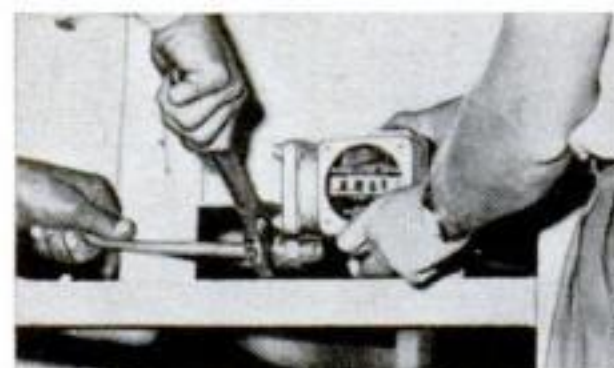


Gas turbine, a cousin of the airplane jet, is an engine that thrives on kerosene or almost any other burnable liquid—may have a passenger-car future. Above is a Chrysler Corp. version.

[Continued on page 216]



◀ **ONE BIG TANK** buried in street holds 10,000 gallons of oil, enough to supply 50 homes.



INDIVIDUAL METERS are installed on basement wall and can be read from outside house.

Fifty oil burners feed from single fuel tank

A centrally located fuel-oil storage tank for supplying 50 homes through metered lines, as forecast in PS [Nov., '60], is being installed in a housing de-

velopment under construction at Poughkeepsie, N. Y. Tri-State Pipe Lines Corp. of New York City has contracts for similar installations to service 1,700



Air lift for game trout

Lakes and reservoirs in Australia are being stocked by air with rainbow and brown trout.

At left a load of baby fish is dropped from the hopper of a crop duster into a lake in Victoria. In each of 17 airlifts, 33,000 fish were transported from the hatchery in which they were bred. Drops of 200 feet did them no harm.



Sliding roof tops new Lancer

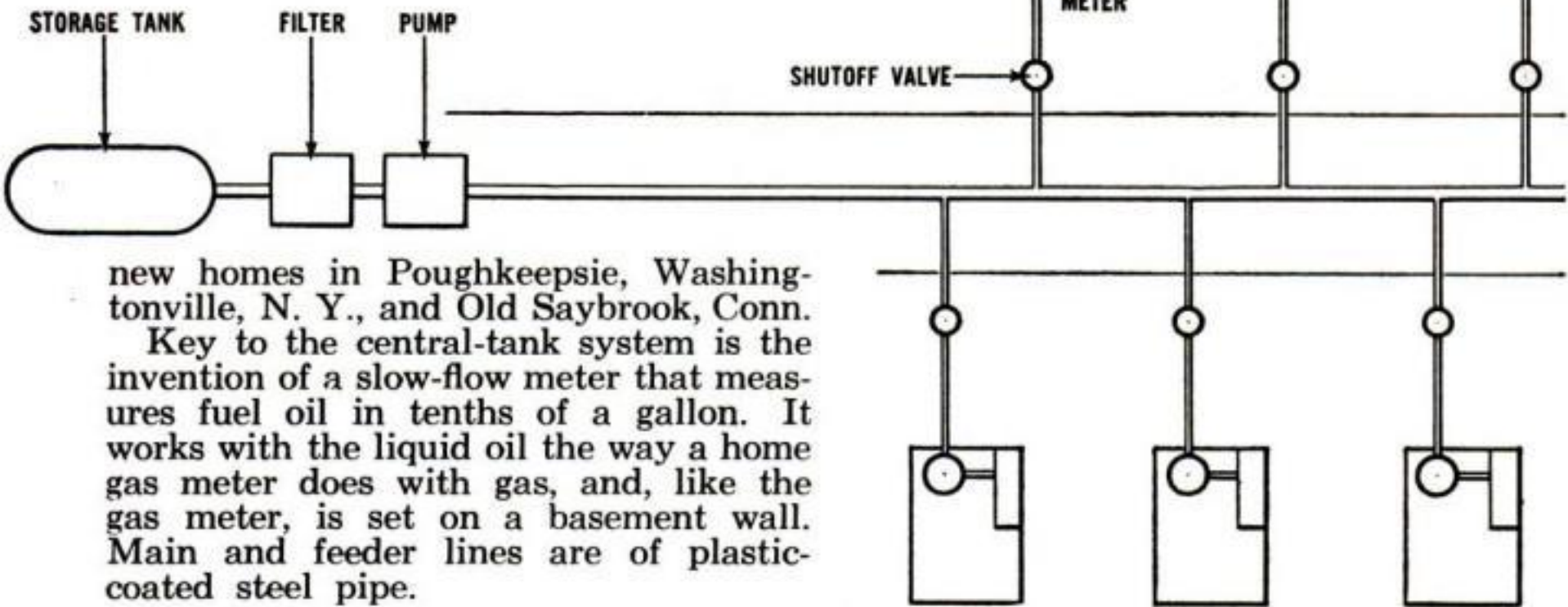
For motorists who like open-air driving, the sliding sun roof found on some foreign cars is now available on the 1962 Dodge Lancer. It's a custom installation you can order from your dealer for \$225 extra. The fabric roof slides on runners and folds back. It's made by Golde Body Parts Div., Warren, Mich.



Rock-and-roll platform

The stability of armored vehicles and tanks is tested by the British Army at its experimental station in Hampshire. A vehicle under test is driven onto a huge platform that can be made to rock and tilt, establishing the angle at which the vehicle will ride before turning over. The platform can handle up to 48 tons.

MAIN FUEL-OIL LINE runs under street with offshoot feeder lines extending from it to service each consumer.



new homes in Poughkeepsie, Washingtonville, N. Y., and Old Saybrook, Conn.

Key to the central-tank system is the invention of a slow-flow meter that measures fuel oil in tenths of a gallon. It works with the liquid oil the way a home gas meter does with gas, and, like the gas meter, is set on a basement wall. Main and feeder lines are of plastic-coated steel pipe.



Tell Shoebbox numbers; it does the arithmetic. Set reservations in Unicall; it speaks okays.

Computers go fancy—one listens, one talks back to you

The dream of a little black box that hears your spoken questions and calls out answers—no monkey business with punch cards or coded inputs and outputs—may be just around the corner.

IBM is showing Shoebbox, a calculator that adds or subtracts instantly the numbers you speak into it. Still experimental, Shoebbox might be found useful by

supermarket cashiers and airplane pilots.

Remington Rand has a machine that speaks answers (to lever-actuated queries): Unicall. The voice replies are prerecorded and stored in a central Univac computer, which selects the right one and plays it into the Unicall telephone. The setup is on sale now for airline, hotel, and auto reservations.

Testing Ford's New "In-Between" Car:

10,000 Miles in a Fairlane

By Devon Francis

HENRY FORD the Elder used to call his Tin Lizzie "the Universal Car." It darned near was for a long period of years.

Now his grandson, Henry II, has produced an automobile called the Fairlane with a lot of today's familiar sheet-metal fat knifed off its exterior.

And you will never guess what Grandson Henry is calling it. Yup, "the Universal Car of the Sixties."

To find out whether Henry II came anywhere near the mark in so describing his vehicle—whether, indeed, he was not besmirching the memory of the beloved

Model T—the staff of POPULAR SCIENCE set forth to wring out this newest car.

The Fairlane was driven hard. At times its tidy, smallish V-8 engine was opened up to the limits of its r.p.m. It was loaded down until even a tar separation strip on the highway caused its springs to bottom. It was fired up after an all-night stand in icy weather.

The POPULAR SCIENCE Fairlane was purchased from a regular dealer at the factory-recommended retail price of \$2,433.30. It was a manual-shift, four-door sedan with radio, heater-defroster, seat belts, and outside rear-vision mir-

HOW THE FAIRLANE DID



THE PERFORMANCE

Total distance covered	10,011.3 miles
Gasoline used (nonpremium)	547 gal.
Average miles per gallon	18.3
Oil burned	None
Gas mileage at constant speeds	
30 m.p.h.	26 m.p.g.
40 m.p.h.	24.5 m.p.g.
50 m.p.h.	22 m.p.g.
60 m.p.h.	20 m.p.g.
Gas mileage in stop-and-go driving	16.9 m.p.g.
Acceleration	
0-60 m.p.h.	13.1 seconds
40-60 m.p.h.	5.4 seconds
50-70 m.p.h.	6.9 seconds

Top speed	100 m.p.h.
Speedometer error	
Indicated Speed	Actual Speed
40 m.p.h.	39.5 m.p.h.
50 m.p.h.	50.5 m.p.h.
60 m.p.h.	61 m.p.h.
70 m.p.h.	71.7 m.p.h.

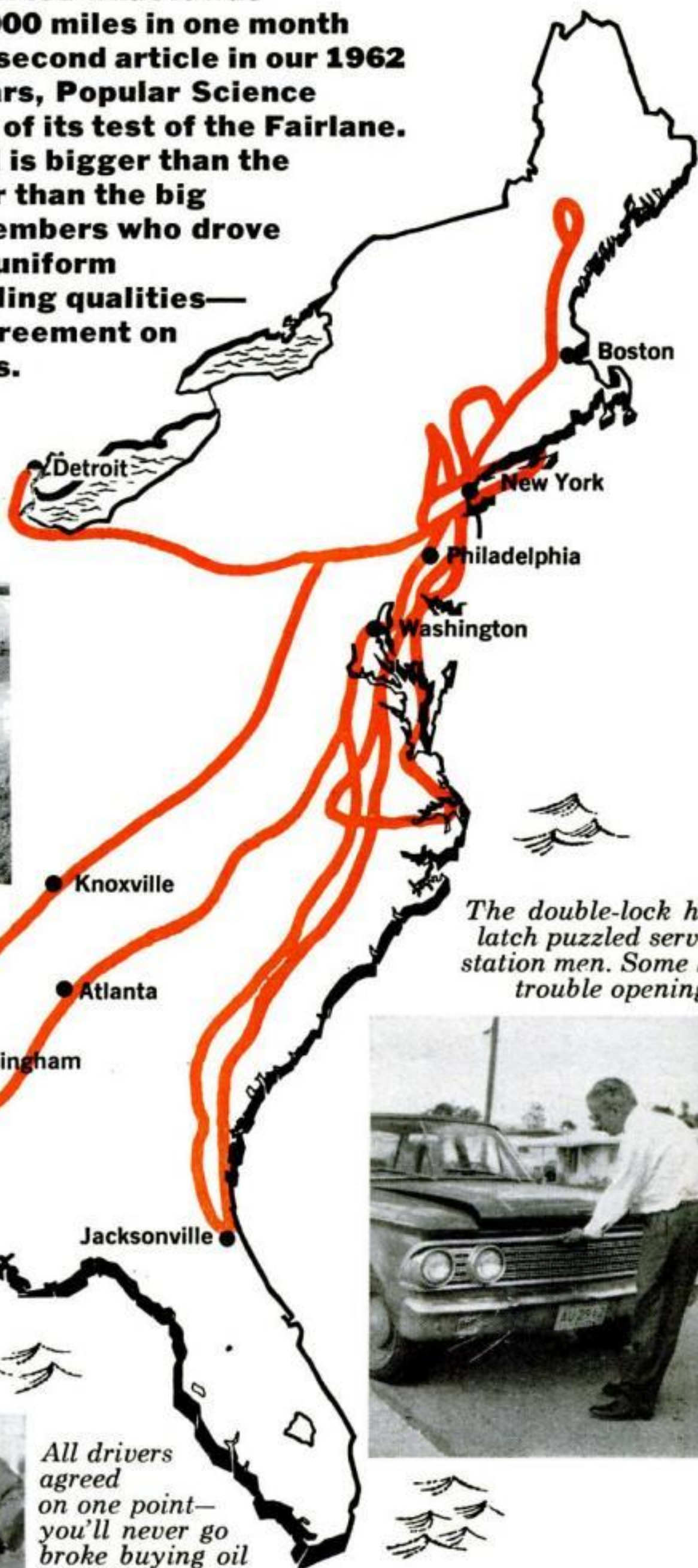
THE COSTS

Gasoline	\$174.71
Oil burned	.00
Gas-oil cost per mile	.0174
Repair and maintenance, including adjustments at 500, 1,000, 5,000, and 10,000 miles	
Oil and filter changes	\$5.40
Lubrication	2.00
Total labor	1.20
Total	\$8.60
Overall direct operating cost per mile	.0183

LAST month we reported what it was like to drive 10,000 miles in one month in a Chevy II. As the second article in our 1962 series on the new cars, Popular Science presents the results of its test of the Fairlane. This mint-fresh Ford is bigger than the little Falcon, smaller than the big Galaxie. The staff members who drove it displayed a fairly uniform reaction to its beguiling qualities—and a remarkable agreement on one of its chief faults.



It's a good turnpike car—smooth at high speeds, restful on a high-mileage run.



The double-lock hood latch puzzled service-station men. Some had trouble opening it.



All drivers agreed on one point—you'll never go broke buying oil for this vehicle.

CONTINUED

How the Fairlane Compared with PS's 1962 Chevy II; 1961 Tempest, F-85, and Lancer; and 1960

	Fairlane	Chevy II	Tempest	F-85	Lancer*
Overall average miles per gallon.....	18.3 m.p.g.	21.2 m.p.g.	20.25 m.p.g.	20.21 m.p.g.	16.3 m.p.g.
Gas mileage at constant speeds					
30 m.p.h.	26 m.p.g.	29 m.p.g.	28.4 m.p.g.	27.9 m.p.g.	21.8 m.p.g.
40 m.p.h.	24.5 m.p.g.	27 m.p.g.	27 m.p.g.	26.8 m.p.g.	20.8 m.p.g.
50 m.p.h.	22 m.p.g.	25 m.p.g.	24.9 m.p.g.	24.9 m.p.g.	18.4 m.p.g.
60 m.p.h.	20 m.p.g.	24 m.p.g.	22 m.p.g.	21.6 m.p.g.	16.1 m.p.g.
Miles per gallon in stop-and-go driving.....	16.9 m.p.g.	20 m.p.g.	18.7 m.p.g.	15.03 m.p.g.	13.8 m.p.g.
0-60 acceleration	13.1 sec.	17 sec.	13.5 sec.	13.8 sec.	11.2 sec.
Top speed	100 m.p.h.	90-plus	96-plus	100-plus	92 m.p.h.
Total oil consumption	None	None	1 qt.	4 qt.	4 qt.
Gas-oil cost per mile.....	\$.0174	\$.0153	\$.0163	\$.0162	\$.0203
Overall direct operating cost per mile.....	\$.0183	\$.0181	\$.0186	\$.0172	\$.0246

*Lancer had optional larger engine, automatic transmission, special "performance" axle.

ror as the sole accessories. Undercoating and antifreeze were included.

Here is the round-table discussion by our staff after 10,000 miles of driving:

Fuel Consumption

Alex Markovich: This car is amazing. It weighs 2,900 pounds. That's hun-



One driver with long legs had trouble—in high gear, the shift lever came down on his right knee.

dreds of pounds more than the so-called compacts, and it's got a 145-horsepower V-8 under the hood. Yet at 60 miles an hour I consistently averaged 20 miles to the gallon.

Everett Ortner: So did I, give or take a fraction of a mile per gallon.

Harry Samuels: It uses very little oil, too. When I drove the car, not a drop had been added in 3,200 miles.

Handling

Hubert Luckett: The car feels stable at high speeds, even with crosswinds.

Frank Rowsome Jr.: That's an odd one. Carrying a heavy load, much of it in the trunk, I was all over the road in strong crosswinds at 75 miles an hour.

Samuels: Yes, it skittered during gusts.

Howard Allaway: But only at speed. I got the same thing at 70.

Luckett: Okay, I'm outvoted, so let's go to the steering. It's precise but heavy.

Ortner: The steering's got a remote feel.

Rowsome: It's slow. There's novocaine in the linkage.

How Well Was It Designed and Built?

It is likely that few motorists will find much to squawk about in the Fairlane. The car is well designed and well built, and is a good performer. Like all cars, it has some faults. Here are some that turned up in the PS Fairlane:

- The shift was stiff, with over-long lever travel. In high gear the lever position was troublesome.

- The car dived on hard braking, and squatted on fast starts.

- It heeled on hard corners.

- It was moderately wind-sensitive, particularly with a loaded luggage compartment.

- Despite a slow ratio, the steering was fairly heavy.

- The windshield produced double images of oncoming headlights at night.

- Hardware on the left front door banged against the knee of tall drivers.

- The wind vents were noisy at speed.

- The radio was squeaky and full of distortions.

Corvair, Falcon, and Valiant

Corvair	Falcon	Valiant
23.43 m.p.g.	26.56 m.p.g.	20.31 m.p.g.
26.6 m.p.g.	30.2 m.p.g.	25.8 m.p.g.
24.2 m.p.g.	29 m.p.g.	24.2 m.p.g.
23.6 m.p.g.	28.1 m.p.g.	23.9 m.p.g.
22.6 m.p.g.	27.1 m.p.g.	22 m.p.g.
21 m.p.g.	22.4 m.p.g.	19.6 m.p.g.
17 sec.	22.9 sec.	17 sec.
88 m.p.h.	78 m.p.h.	96 m.p.h.
4 qt.	1 qt.	3 qt.
\$.0145	\$.0122	\$.0163
\$.0184	\$.0147	\$.0206

The car's styling is conservative and unassuming, yet it got a lot of attention.



Markovich: How much faster could they make it without power assist? Consider the car's weight. What Ortner calls a "remote" feeling is understeer.

Ortner: The rear end wants to break away in a tight, hard turn.

Rowsome: The car also heels over.

Luckett: Okay, but it doesn't wallow.

Markovich: That back end feels all right if you know how to control a skid.

Rowsome: Hasn't anybody got a comment on the shift linkage?

Luckett: I have. The location of the shift lever in high gear seemed idiotic to me. It hits your right knee. It interferes with handling.

William Morris: The position of that stick in high is right in the lap of the middle passenger.

Rowsome: Except when the seat is fully back—which is where you don't want it with rear-seat passengers.

Markovich: The shift is less than ideal. The one-two is stiff, with a long throw and an exaggerated dog-leg.

Allaway: Let's grant all that. But the Fairlane still is a fine-handling automobile. You really have to go out of your way to find fault with it.

The Ride

Morris: The car rides harder than my '56 Ford.

Luckett: The ride's still boulevardry.

Samuels: It suited me perfectly.

Markovich: It's firm, more so than the Mercury Meteor's. That's the Fairlane's opposite number in the Merc line.

Morris: The back seat rides comfortably.

Markovich: The ride depends on how much of a load you've got. With five adults aboard, including a 230-pound brother-in-law, and two kids, and a trunk

Engine idles so smoothly you find yourself jazzing the throttle to make sure it's running. Acceleration isn't neck-snapping, but it's good in second, which is useful in heavy traffic.





Fairlane got a breather along the Hudson. In background are "mothballed" ships.

full of suitcases, the spring bottomed on every tar strip.

Samuels: With a load like that, you should be driving a truck.

Performance

Luckett: That's quite an engine—smooth as silk at every speed.

Ortner: The car's got plenty of pep for passing.

Markovich: The acceleration's smooth. It's plenty fast for anything but drag-racing.

Luckett: The engine picks up without a whimper from 10 miles an hour in high.

Markovich: That's right. Furthermore, it idles so quietly that I found myself tapping the pedal to make sure I wasn't stalled out.

Allaway: I did find that at 25 miles an hour the car was happiest in second.

Design and Construction

Luckett: There's plenty of head room and leg room except for that shift lever. The steering wheel banged my knees too.

Rowsome: Amen.

Allaway: The ash tray's big enough to knock out a pipe in.

Morris: The assembly's fine. No leaks.

Ortner: So's the heater, and the fan's

quiet. Heat poured out without a whisper.

Rowsome: The car's free of rattles.

Markovich: All the controls are handy.

Safety and Comfort Features

Rowsome: My worst squawk is the windshield. Anybody notice how it's slanted in such a way that it shows double images?

Ortner: Yes, at night an oncoming car has ghost headlights. Everything coming at you looks like a Fruehauf.

Morris: The windshield reflects the radio-speaker grille in the daytime.

Rowsome: Then there's the brakes. You can feel the servo effect come in—they tighten up on you.

Allaway: Yes, the car dives on fairly hard stops.

Rowsome: That's partly the suspension, of course, but here's another thing—the brakes are self-adjusting, and when you've got a back-down driveway, they set up too tight for the next day.

Luckett: The pedals are nicely spaced, and it's a safety feature that you can downshift easily from high up to about 45 m.p.h.

Summing Up

Allaway: Maybe I'm just not critical, but I liked practically everything about the Fairlane. It's as much a car in size and performance as the average family really needs.

Markovich: It's easy to drive, completely predictable, and it hasn't got a really ornery screw or nut in it—except for that shift. ■ ■

NEXT TEST: 10,000 miles in a stick-shift Rambler American—without a clutch pedal.

How the Fairlane's Tires Stood Up

A tire expert measured tread depth at 10,011 miles. The 7.00 x 13 Firestone tires had not been rotated. The left front tire had lost 34 percent of its tread, the right rear 36, and the right front and left rear 30. His estimate of projected tire life: 32,000 miles on four tires, or 40,000 on five switched.

"I'd like to see them make..."

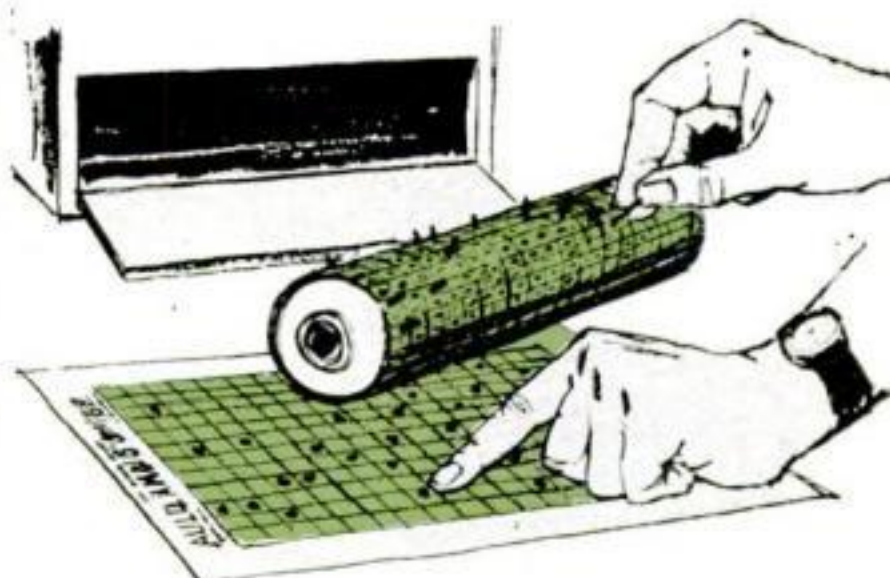


THROW-AWAY SHEETING on rollers at head and foot of a bed. To make the bed, you'd pull out

a clean section of soft, clothlike paper from each roll.—*Evelyn McGraw, NYC.*



A FOOT-WARMING HUNTING BOOT with electrical wires in the lining. The battery could be slipped into a pocket in the heel or on the pants leg.—*Bob Montgomery, Rockford, Ill.*



A MOTOR-DRIVEN MUSIC BOX with a drum using movable pins. Then you could change the tune, following a direction sheet for placement of pins.—*F. Harry Loudon, Sarasota, Fla.*



SECTIONAL TIRE CHAINS with snap-fastened cross chains. Worn lengths could be removed and replaced easily with new chain, using the same snap hooks.—*Andrew Vena, Philadelphia.*



PLIERS WITH SCREWDRIVERS on the handles. With a Phillips driver on one end and a regular driver on the other, you'd save space in a toolbox.—*Ken Sandvik, Two Harbors, Minn.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's yours? We will pay \$5 for each one published. Please use Government postcards

only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 17. Write your name and address clearly. Contributions cannot be acknowledged or returned.



Shelter floats like a boat, but to be effective against fallout it has to go underground.

Convertible fallout shelter makes like a houseboat

Here's a fallout shelter so watertight it will float and, powered by an outboard motor, can be used as a houseboat. But if you intend it for protection against H-bomb fallout, you had better have a deep hole close to the shore so you can get it underground in a hurry.

It's 12 feet long, 8 feet in diameter, is built completely of aluminum, and is called a RAM, for Radiation Ark-Mobile. The designers, Diversified Fabricators, Inc., Niles, Ohio, showed it afloat to demonstrate its resistance to seepage when buried in low ground. Mounted on a wheeled cradle, it can also be used temporarily as a house trailer.



ROOMY INTERIOR provides family living space in "miniature graciousness," say the builders.



PILLARLESS WINDOWS add to racy look of the four-cylinder car. Top speed is 80 m.p.h.

Sporty little British Ford

English Ford is now putting out a new model, the Capri, based on the Consul Classic 315, with a sweeping "aerofoil" hardtop that holds overall height to four



SPACIOUS TRUNK holds 22 cu. ft. There is room in the rear for overflow luggage.

feet, four inches. The two-door has front bucket seats and room behind for children. It's powered by an oversquare 56.6-hp. engine displacing 82 cu. in. Floor or optional column shift is offered. Disk brakes are on the front wheels.

Desert Patrol Rescues Stranded Travelers



ALERTED BY PHONE CALLS from sheriff's office and signals on local radio, squad meets to plan operation.

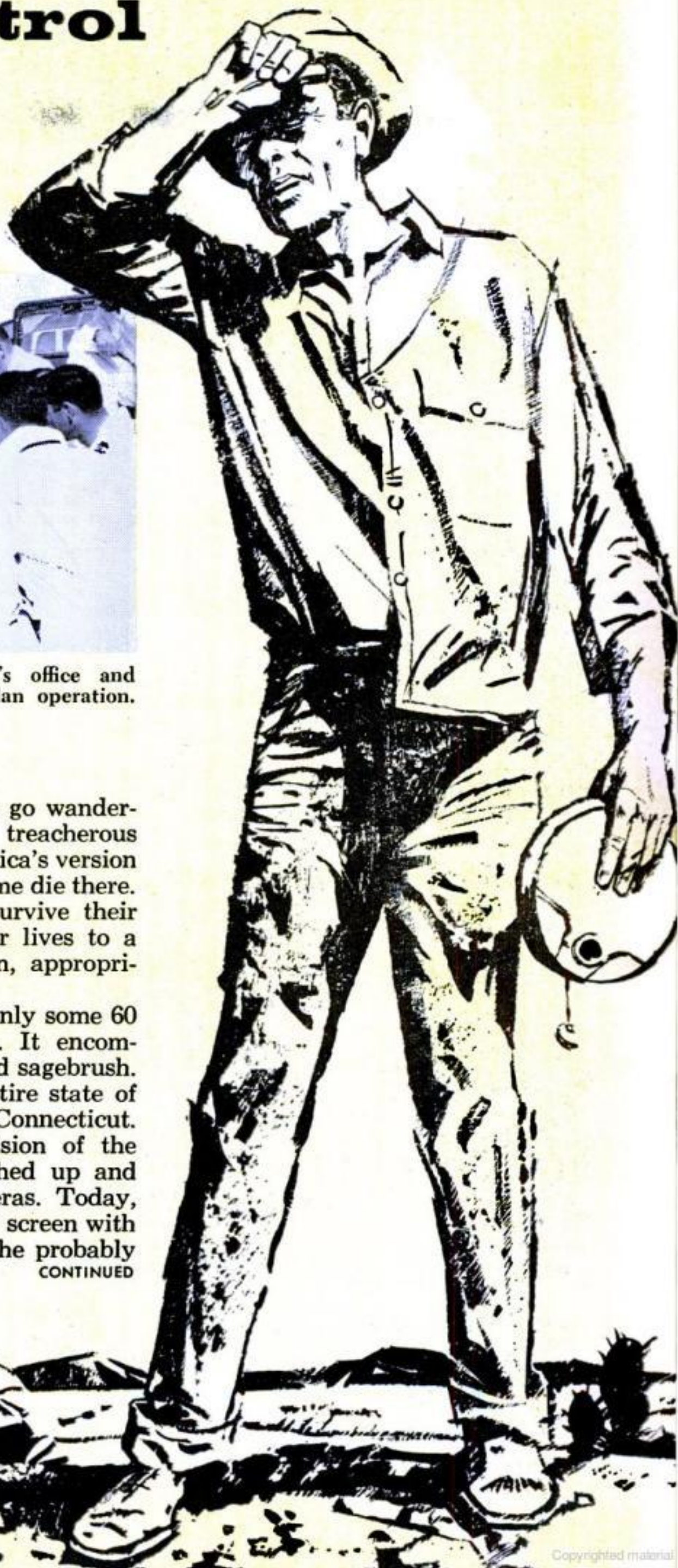
By Jack B. Kemmerer

EVERY year, scores of motorists go wandering off into one of the most treacherous areas of their native land—America's version of the Sahara, the Mojave Desert. Some die there. Most make it back. Of those who survive their foolishness, a tidy number owe their lives to a volunteer desert-rescue squad known, appropriately, as the "Angels on Wheels."

California's famous desert begins only some 60 air miles northeast of Los Angeles. It encompasses 15,000 square miles of sand and sagebrush. That's an area half as big as the entire state of South Carolina, three times as big as Connecticut.

For decades, the Hollywood division of the "French Foreign Legion" has marched up and down its dunes for the movie cameras. Today, when you see a character on your TV screen with his tongue unhinged in killing heat, he probably

CONTINUED





ON REACHING SEARCH AREA, drivers receive radio instructions. When enough men are available, there are two observers in each jeep.



WHEN GOING GETS TOUGH, the desert rescuers straddle "Tote-Gotes" — three-hp. chain-drive scooters that can climb rock outcroppings.



GEM-STONE HUNTERS often become desert victims in rocky, rugged areas like this, where it's easy to slip and fall.



ABANDONED JEEP is located. As two rescuers remain to dig it out

has been videotaped in the Mojave.

In summer the Mojave's daytime temperatures reach 125 degrees. In winter its nights fall almost to zero.

People get lost or stranded in the Mojave when they drive off the main roads on innocent explorations. Their cars bog down in the soft sand. Often they carry no drinking water or extra gasoline. Seldom are they properly dressed; the heat—or cold—gets them.

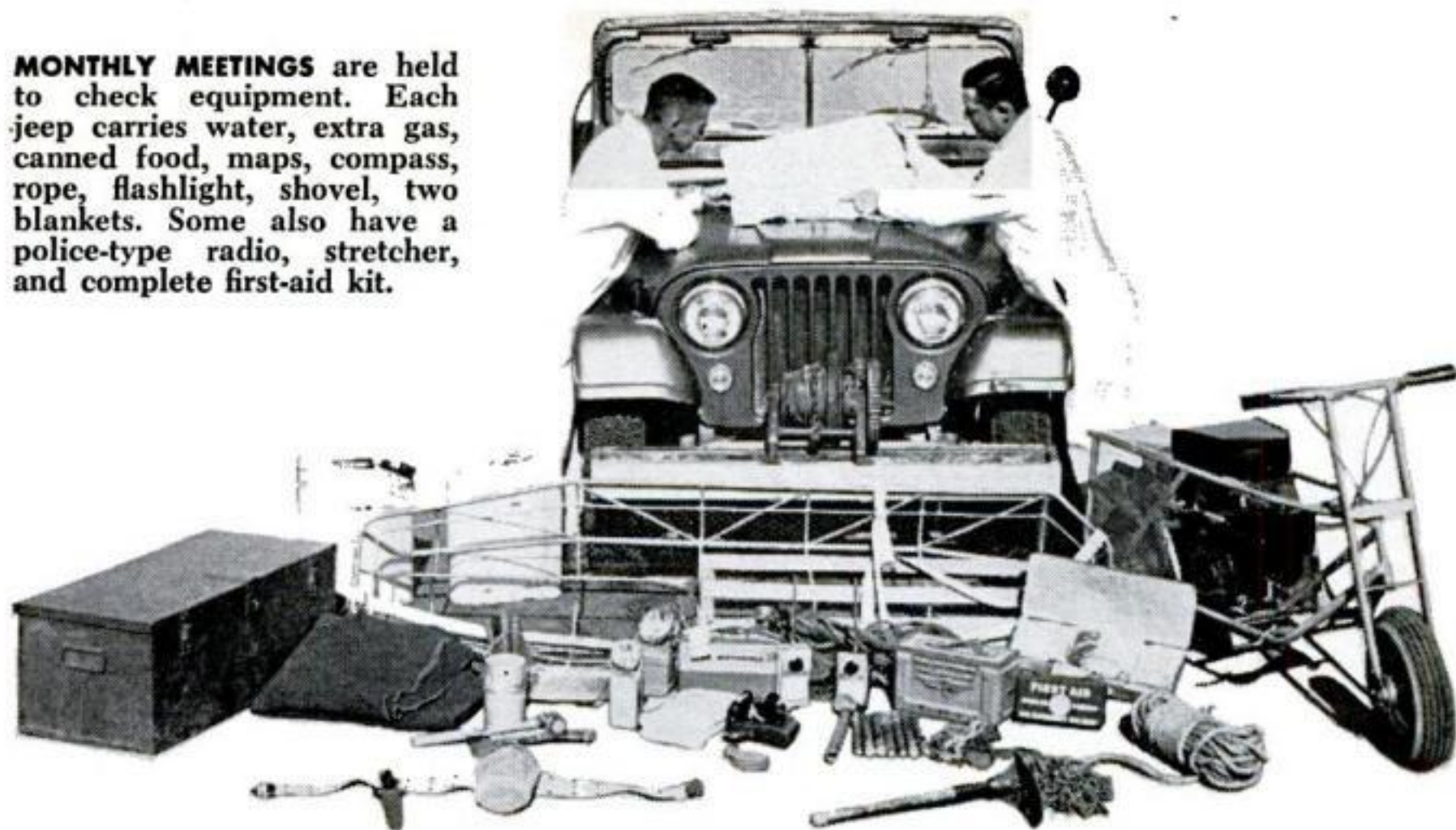
One of the rescuers' biggest headaches are the "rock hounds"—gem seekers. Occasionally private and military planes crash-land in the Mojave's wastes.

The rescue squad is equipped to cope with these emergencies. It hunts the lost in jeeps fitted with two-way radios. When the squad has to search at night, the jeeps line up abreast, spread out across the desert floor, with men afoot carrying walkie-talkies for communication among the vehicles.

Everybody feels good when the squad wins. One bitter night last winter it found a small girl, clad only in a light cotton dress and sweater, after an hours-long search. It was in the nick of time. The child could not have survived much longer, a doctor said.

Now and then the squad loses. Last summer a man and wife got bogged down in the sand 27 miles off a main highway. The man decided to hike out for help. The woman, staying with the car, survived. Her husband was found dead of dehydration.

MONTHLY MEETINGS are held to check equipment. Each jeep carries water, extra gas, canned food, maps, compass, rope, flashlight, shovel, two blankets. Some also have a police-type radio, stretcher, and complete first-aid kit.



The Mojave's desert-rescue squad is quite new. It was formed in 1958 by eight men headed by police officer H. O. Davis of Barstow, smack in the middle of the Mojave. Today the Angels number 50, with a transport system of 16 jeeps, a carrier for rescue equipment, and four pickup trucks.

Wearing distinctive white coveralls and shoulder patches, the squad members supply their own vehicles and other rescue equipment. Nobody pays them a cent for their work.

Since the foolishness of wandering off into the desert is not illegal but only

dangerous, the rescue squad has had to engage in an educational campaign. Thousands of cards, liberally distributed, carry a dozen helpful hints to dispel the ignorance of the blissful.

The main ones:

- Register at the nearest town. Tell where you're going and when you plan to return.

- Carry drinking water, extra fuel.

- Don't walk far in the heat of the day.

- If stuck, stay with your car.

- Don't panic. Rescue will soon be on the way. ■ ■



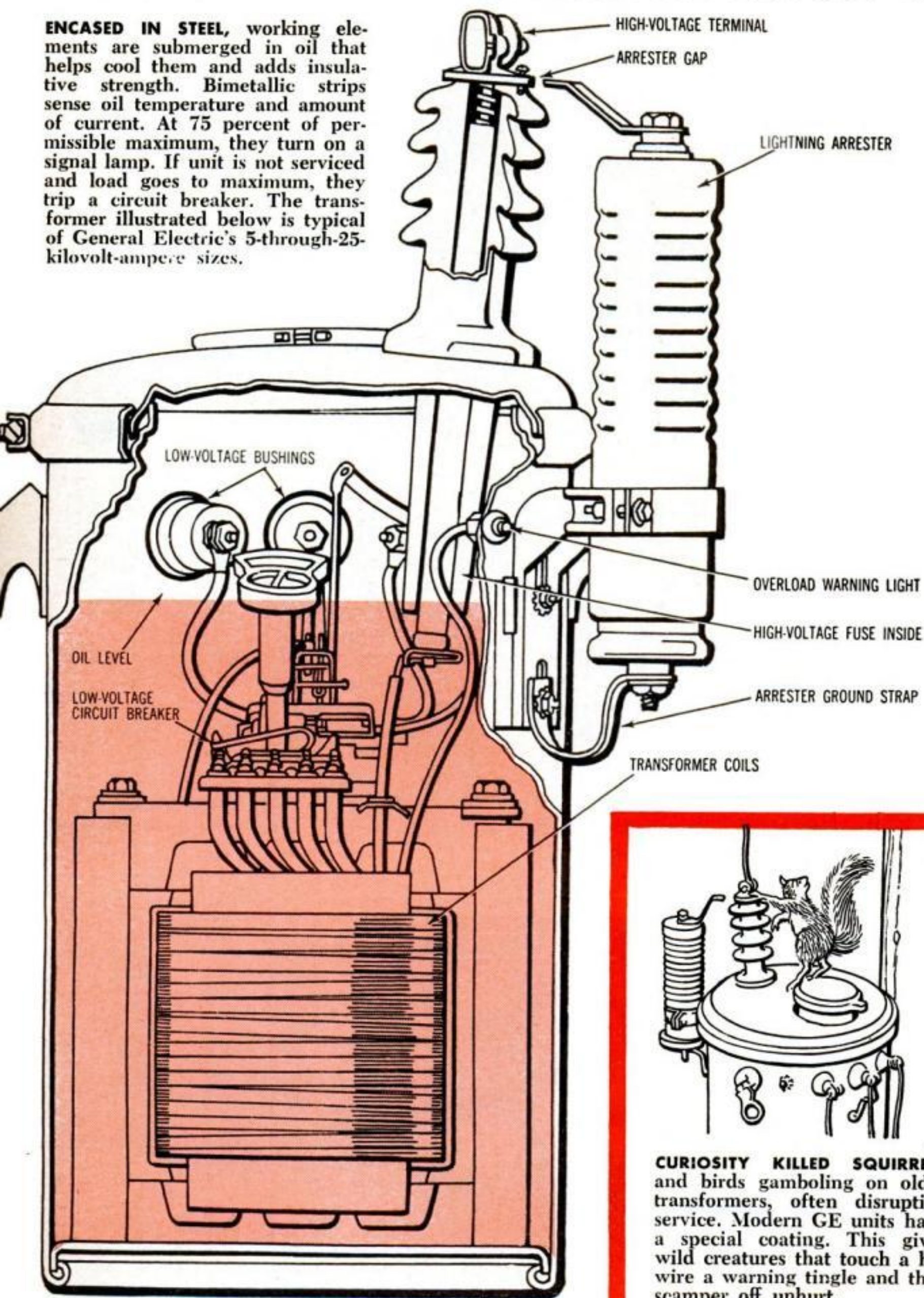
of sand, first-aid men set out to hunt for the vehicle's driver.



EVERY MAN IN SQUAD must complete a first-aid course. Here it came in handy when a rock hound was found injured.

How the Transformer on

ENCASED IN STEEL, working elements are submerged in oil that helps cool them and adds insulative strength. Bimetallic strips sense oil temperature and amount of current. At 75 percent of permissible maximum, they turn on a signal lamp. If unit is not serviced and load goes to maximum, they trip a circuit breaker. The transformer illustrated below is typical of General Electric's 5-through-25-kilovolt-ampere sizes.

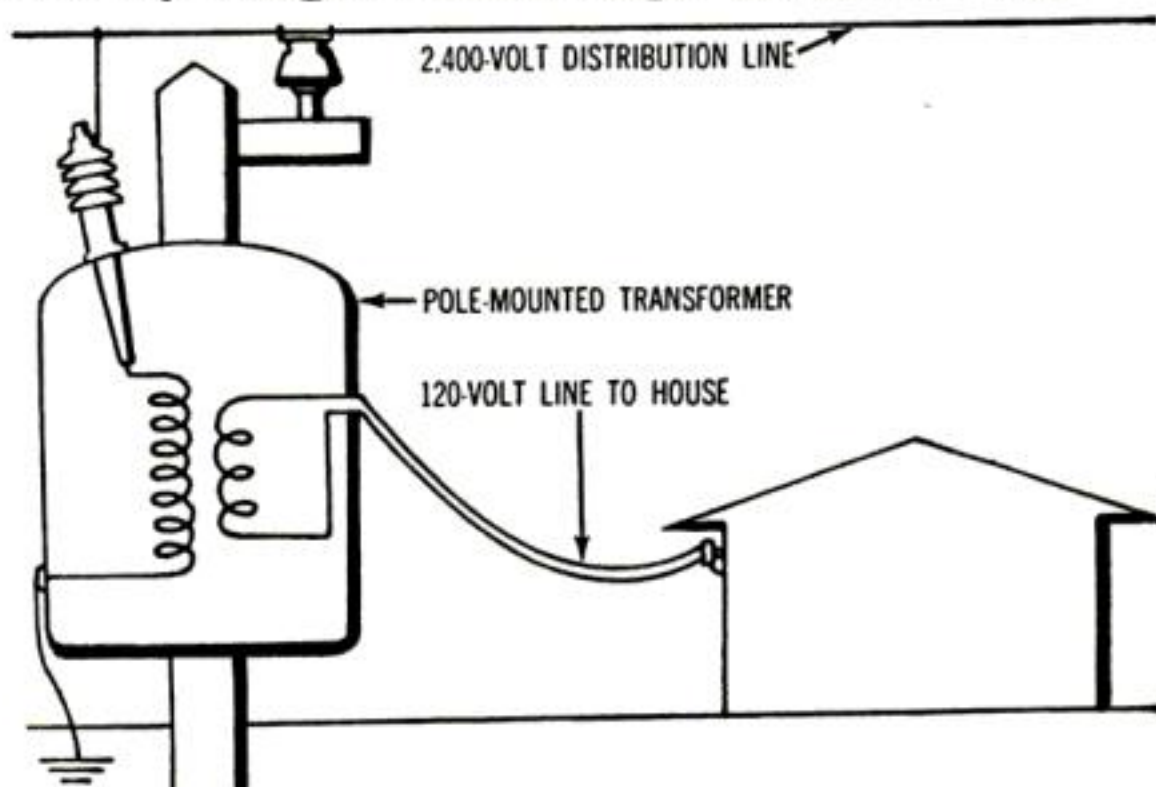


CURIOSITY KILLED SQUIRRELS and birds gamboling on older transformers, often disrupting service. Modern GE units have a special coating. This gives wild creatures that touch a hot wire a warning tingle and they scamper off unhurt.

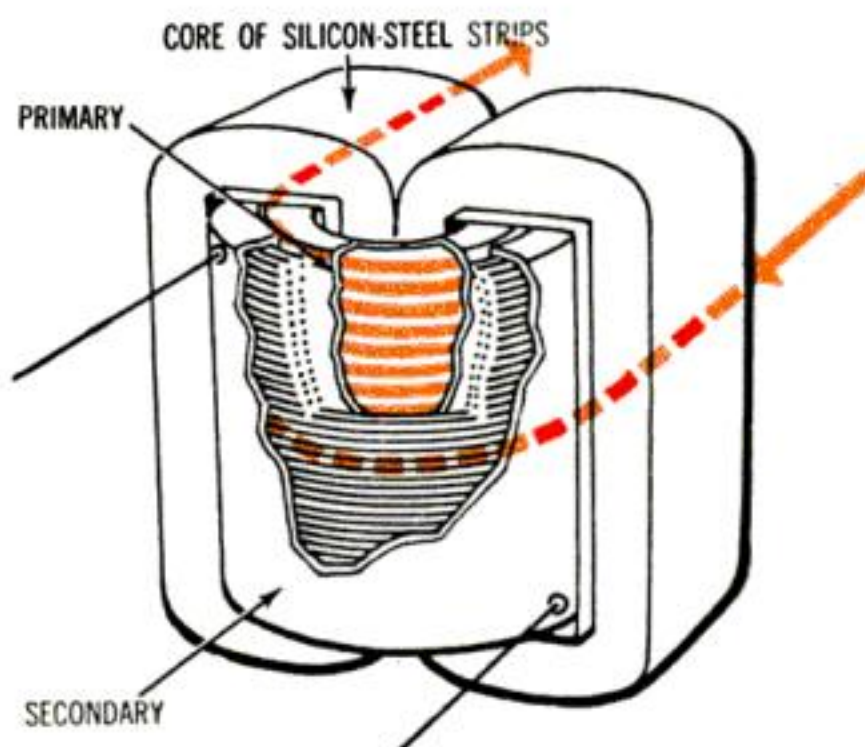
Your Power Pole Works

What's inside the case that chops high line voltage to house size

ELECTRIC POWER is the product of voltage and amperage. Ten kilowatts may be 100 amps at 100 volts, or 10 amps at 1,000 volts. To send the first any distance without much loss in voltage and great waste due to heating of wires would require thick, costly conductors, for heat loss mounts as the square of the current (amperage). For 1,000 volts, the wire can be much thinner, and heat loss from 10 amps is negligible. So electricity is transmitted at 2,400 volts or more. Near your home, a distribution transformer steps it down to 120 or 240 volts for use.

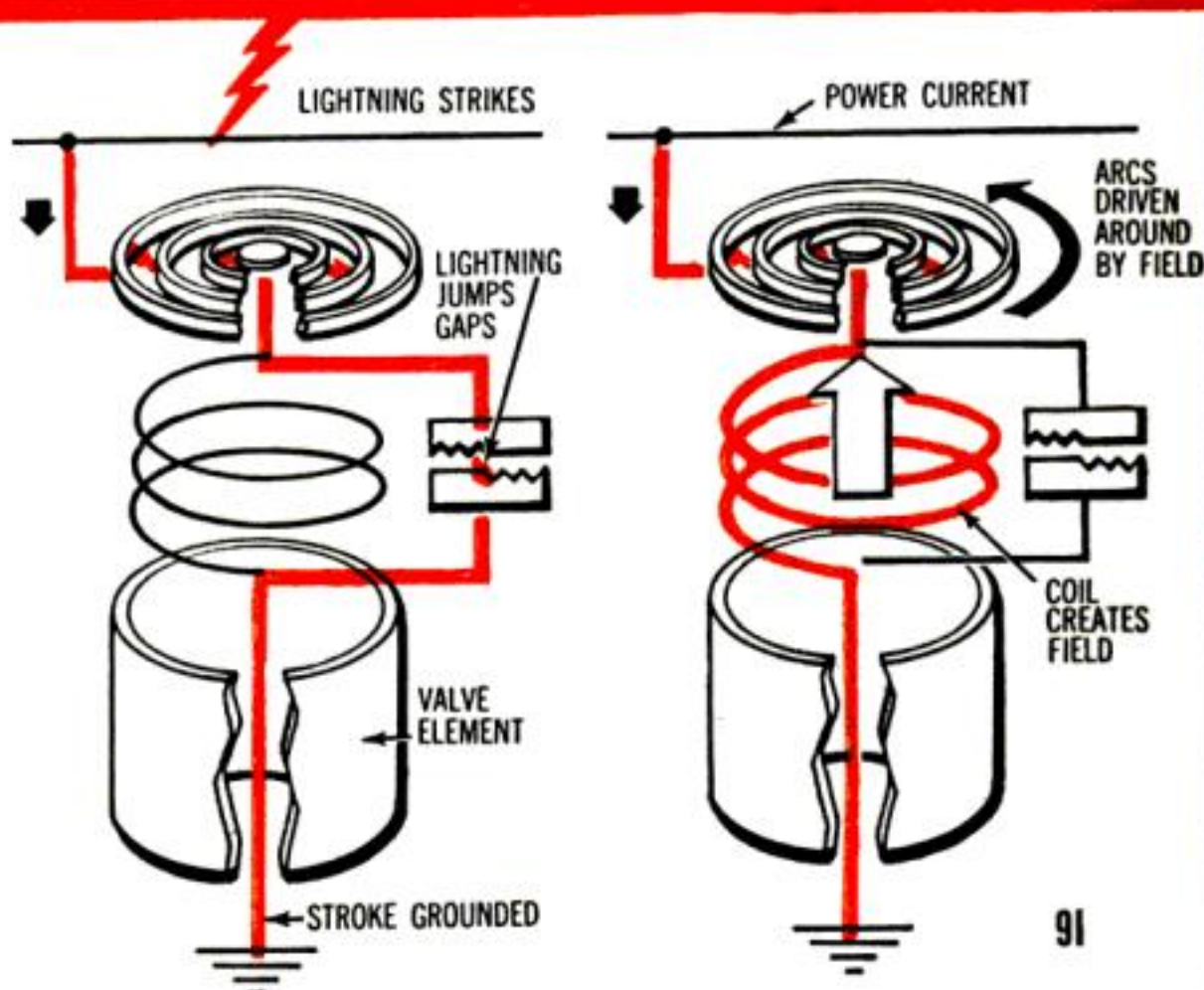


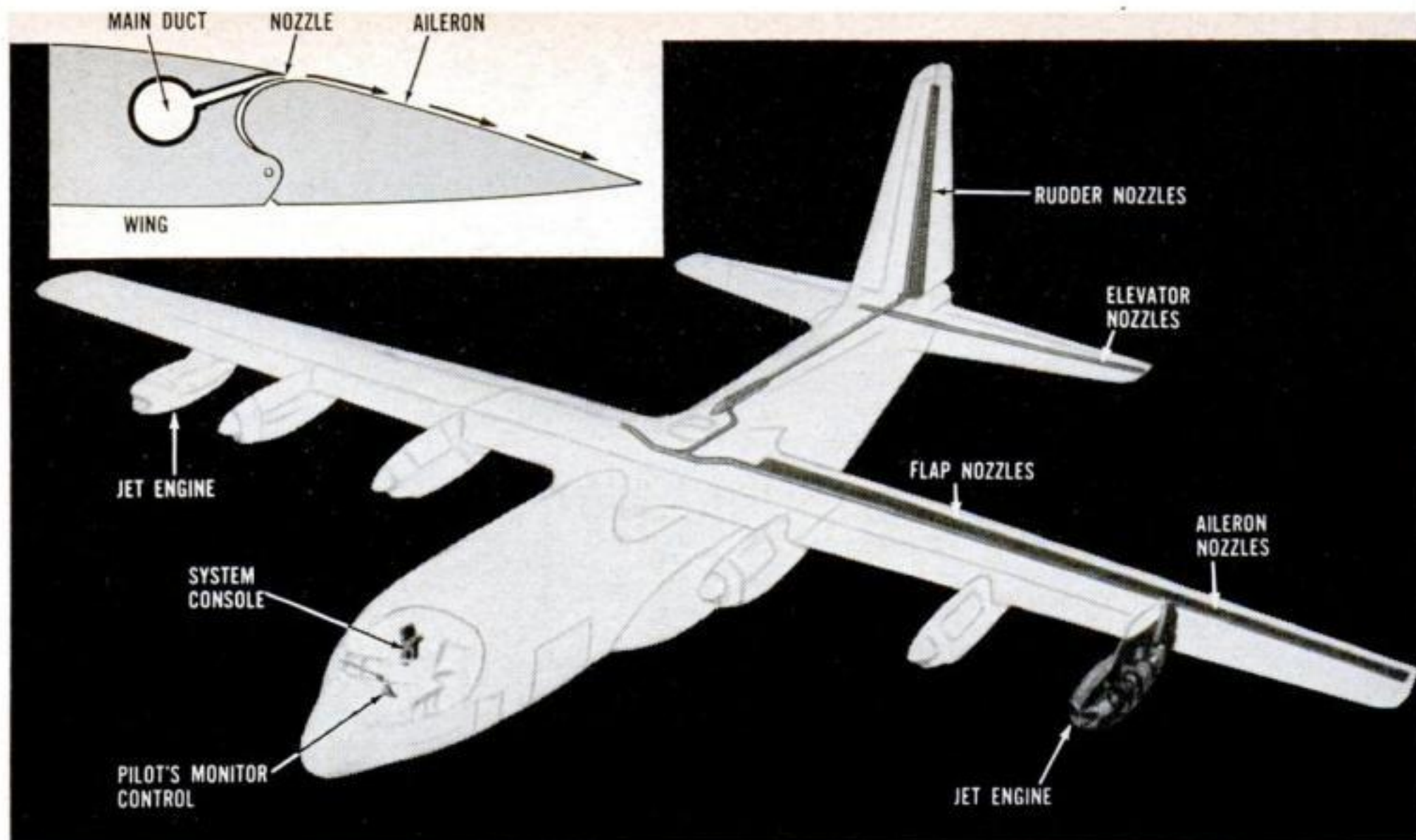
WHAT CONVERTS ELECTRICITY from high voltage at low amperage to familiar house current is a pair of wire coils on two loops of silicon steel (right). One coil—the primary—is connected to supply line as above. The other—the secondary—has only 1/20 as many turns, half inside, half outside the primary. Voltage makes current flow in the primary, creating a magnetic field. This induces an opposing voltage in the same winding, which limits primary current, and in the secondary a voltage 1/20 of that. Secondary current to your house creates a field that weakens the primary's, and the opposing voltage. This lets more primary current flow in exact proportion to house demand. Except for small losses, the transformer consumes no power.



When lightning strikes the power line

CURRENT CAN'T JUMP arrester air gap (top of facing page), but lightning prefers it to transformer windings. In the arrester, it jumps ring gaps (right), detours a coil that—like windings—has great impedance at high frequencies, hops a shunt gap, and, through a semiconductor "valve" that passes high voltage more easily than low, goes to ground. Power current follows by arcing over flash path (far right) but prefers coil to its gap. Coil's magnetic field swirls arcs about so fast they can't keep any spot hot. So cooled, arcs are doused in half a cycle (1/120 second).





MAKING A PLANE FLY SLOWER is a matter of ventilating wings, control surfaces, and land-

ing flaps. Drawings above show duct system for "boundary-layer control" with air that is put

Drill holes in the wing and—

62-Ton Plane Stops on a Dime

By Wesley S. Griswold

OUT at Moffett Field, Calif., these days, a 62-ton cargo plane is cutting up like a Cub. It's an astonishing and rather droll sight, as if an overgrown dog had suddenly started acting like a puppy. But the Army and Air Force are pleased and inspired by it.

The big machine is able to take off and land in only 500 feet, sometimes less. Considering that it weighs 124,000 lb., is 99 feet long, 38 feet high at its tail-tip, and spreads its wing nearly 133 feet, that's downright dramatic behavior.

Any other plane of the same size requires $2\frac{1}{2}$ -3 times that distance.

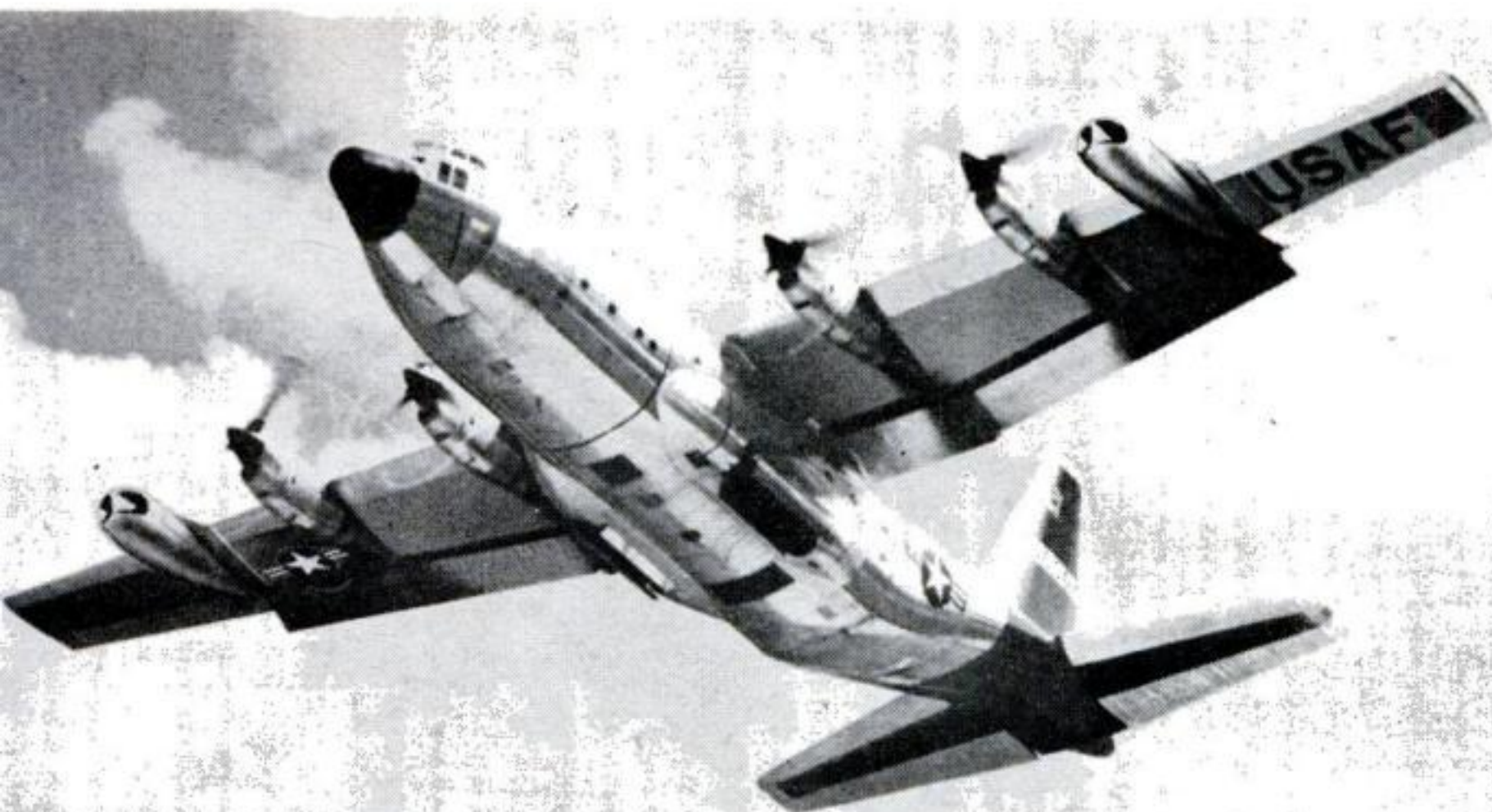
"It just seems to squat and stop on a dime," declares a Moffett Field groundling who has watched it land many times.

Experimental, this airplane has gone a long way toward solution of a problem—safe flight at low speeds. Aeronautical engineers have talked about solving this one almost since the first fatal crash of a powered heavier-than-air machine a half-century ago. It isn't completely whipped yet. But it's a safe guess that low-speed takeoffs and landings by propeller-driven planes, including perhaps airliners, soon will be commonplace.

The bulky but bouncy plane at Moffett Field is a Lockheed C-130B cargo carrier that also goes by the name of Hercules. It is powered by four turboprop engines. This Hercules, however, is like none other of its breed ever built.

The secret of its skill. Its remarkable performance rests in two terms contracted into STOL (Short Takeoff and Landing) and BLC (Boundary-Layer Control). STOL depends on BLC. Here's why:

The boundary layer of air is the layer closest to the skin of a plane in flight. At low speed and/or high angle of wing



under pressure by two jet engines. Taking off, experimental Lockheed Hercules cargo carrier

uses 800 feet less runway than identical plane without BLC, and is airborne at less speed.

attack, that layer stops flowing smoothly over the plane's wings and control surfaces, and breaks up. When this happens, the wings lose their lift and the controls their "bite" on the air. The plane starts falling. Loss of lift is most critical, naturally, at takeoff and landing.

It has long been known that if a way could be found to postpone boundary-layer separation, the craft would gain greatly in lift. This would enable it to take off or land in much shorter distances. It would also permit it to slow

down sharply in level flight without stalling.

Trial and error. For years, designers experimented with boundary-layer control only on the wing, theorizing that more lift was the nub of the problem. More lift worked, but the control surfaces—ailerons, elevators, and rudder—got sloppy and ineffective at low speeds.

Then attention was shifted to maintaining air flow on the control surfaces to insure their effectiveness at low speed.

[Continued on page 218]

Why STOL?

This 600-m.p.h. jet "ran out of runway" attempting a landing at Boston, and wound up in a mud flat. No one was killed or seriously injured. The apparent trouble: excessive speed in its final approach. A perfected STOL system, by cutting down the 135-m.p.h. speeds at which jets come in over the fence, would greatly ease pilots' problems in landing safely and smoothly.



Jet ejection seat saves a life

Many photographs in the past have shown test ejection by rocket seat of human and dummy pilots. Here's a dramatic action sequence of the real thing.

When Lt. (j.g.) John T. Kryway tried to land his F8U-1 Crusader on the flight deck of the carrier Franklin D. Roosevelt in heavy weather, Photographer's Mate Louis C. Cera got these pictures.

Kryway made his approach at a normal 150 m.p.h. Waves pounded by a

40-mile wind caused the deck to drop. Kryway reduced speed but hit the deck at a steep angle. One of the jet's landing wheels broke off, and friction of the impact ignited its magnesium strut.

The plane kept going. Then its tail hook caught the arresting cable, but broke, and the pilot was forced to eject. Photos show the results.

Kryway was picked up by a rescue helicopter. No damage except to the jet.



3. Plane breaks away from arresting gear.



4. Plane heads toward edge of flight deck.



7. Pilot and canopy are thrown clear.



8. Jet heads for water, pilot turns flip.



Citroen is Siamese twin

The fire department at Draguignan, France, welded the fronts of two Citroen 2CVs together to make the strange-looking vehicle at left. It's used with two drivers in fighting forest fires. One drives as close as possible to spreading flames while the other directs firemen by radio. When the blaze gets too hot, the vehicle can scoot off without turning around.



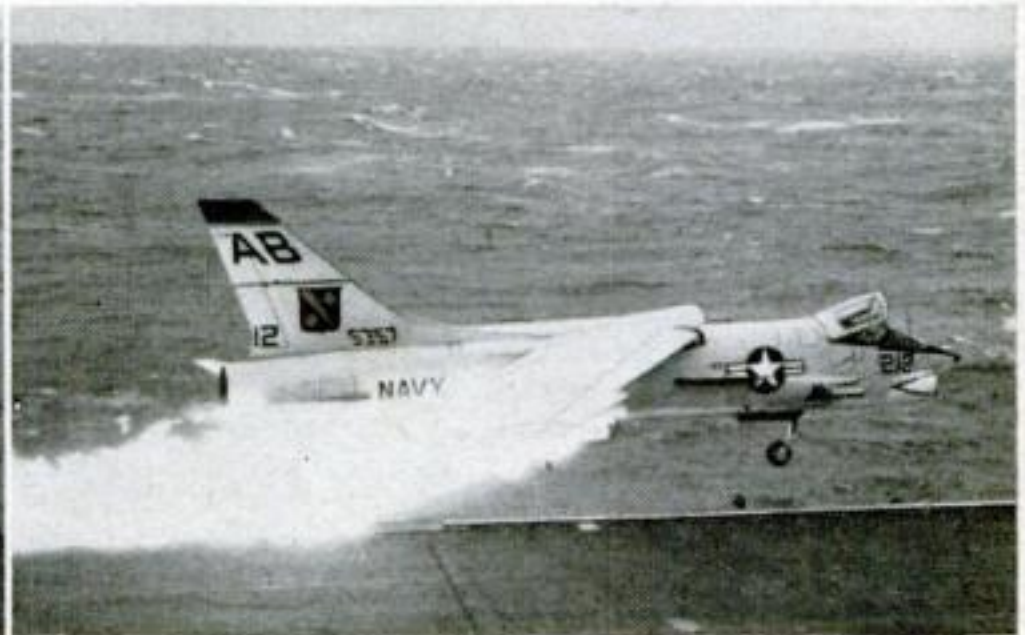
1. Landing wheel breaks off on impact.



2. Magnesium wheel strut bursts into flame.



5. Pilot begins ejection procedure.



6. Canopy of burning plane starts to separate.



9. Jet splashes, chute begins to open.



10. Chute is opening as ejection seat falls away.

Mechanical grasshopper

Brush and weeds are kept off the tracks of the Chicago & Northwestern with this track-mounted cutter. Chain saws on the ends of its hydraulically operated arms can cut through small trees, old utility poles, and fence posts within its 21-foot reach. The cutter was developed by the railroad and Northwestern Motor Co. of Eau Claire, Wis.





Machines serve and heat food automatically . . . and one machine changes bills into coins.

Latest in restaurants: a cook-it-yourself cafeteria

In this new restaurant, the customer not only serves himself but also heats up his own meal. It's the latest New York City outlet of the White Tower chain. Being all automatic, it has been rechristened Tower-O-Matic. There are no waiters, waitresses, or cashiers.

A customer selects a precooked dish from coin-operated vending machines, pops it into a pushbutton electronic oven

that gives off radar energy to make the food piping hot in 30 to 60 seconds without heating the plate.

The oven, called Radarange, is made by Raytheon Co.; the vending machines—also offering salads, sandwiches, pastries, pie cuts, and hot and cold drinks—by Automatic Canteen Co., which provides, besides, a bill changer that converts dollars into coins.

Powered sled tows winter-sport loads on ice or snow



A new one-man vehicle pulls skaters, skiers, a toboggan, or even an ice-fisherman's shanty at 16 m.p.h. It's driven by a four-hp., four-cycle, air-cooled Kohler K91 one-lunger that powers a chain-clad center wheel. It runs on ice and hard-packed snow on three runners, one for steering at the rear between the outer pair. On softer snow, skis replace the runners. Ice Skeeter is made by Northern Mfg. Co., Oak Harbor, Ohio.





**12 LESSONS BY
A POLICE JUDO EXPERT**

Unarmed Self-Defense

***The bigger they come,
the harder they'll fall, if
you learn these holds***

Adapted from the book *Modern Judo and Self-Defence*, by Harry Ewen (Emerson Books, Inc., New York, \$3.95); adaptation by the editors of *POPULAR SCIENCE MONTHLY*. © 1957 by Harry Ewen.



CONTINUED 97

Unarmed Self- Defense

Three ways to defend yourself

THE best method of self-defense is to be inoffensive. But if somebody attacks you, your surest defense is a sound knowledge of the measures, based on judo, that are outlined here. Your teacher is Harry Ewen, a top British police instructor of judo.

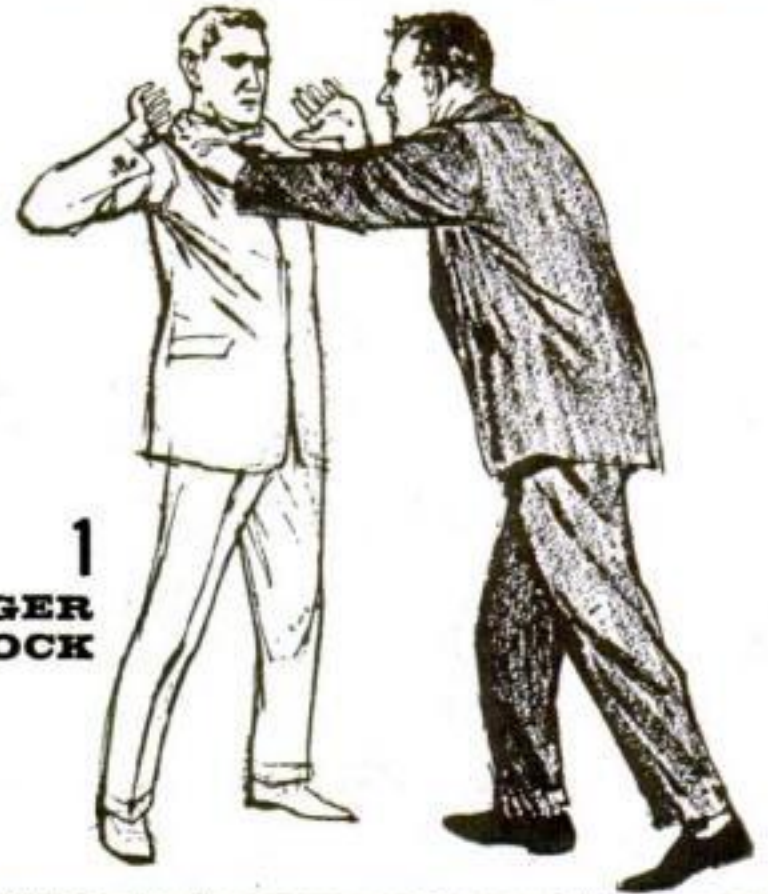
If you learn these ways of defending yourself, you'll certainly have a better chance of surviving a brawl. Basic training in judo, however, will enable you to counter *any* kind of physical attack, even types not shown here.

Judo is the sport form of jujitsu, a style of combat that originated in China 2,000 years ago. It became a sport in 1882 when a Tokyo doctor, Jigoro Kano, formed the first club devoted to it. Dr. Kano filtered out of jujitsu the movements that seemed too dangerous for a beginner to practice. He thus made judo a sport that anybody could enjoy without getting maimed. Commando training in World War II gave judo's popularity a sharp boost. Today there are judo clubs throughout the world.

The ideal way to learn this sport is from an experienced instructor. Most

[Text continued on page 102]

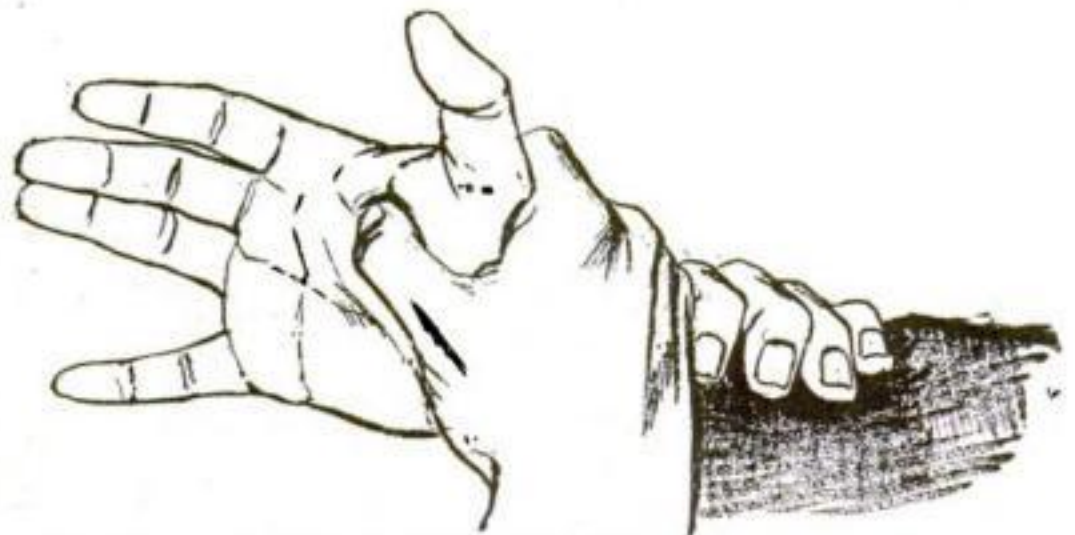
1
**FINGER
LOCK**



2
**NOSE
BREAK**



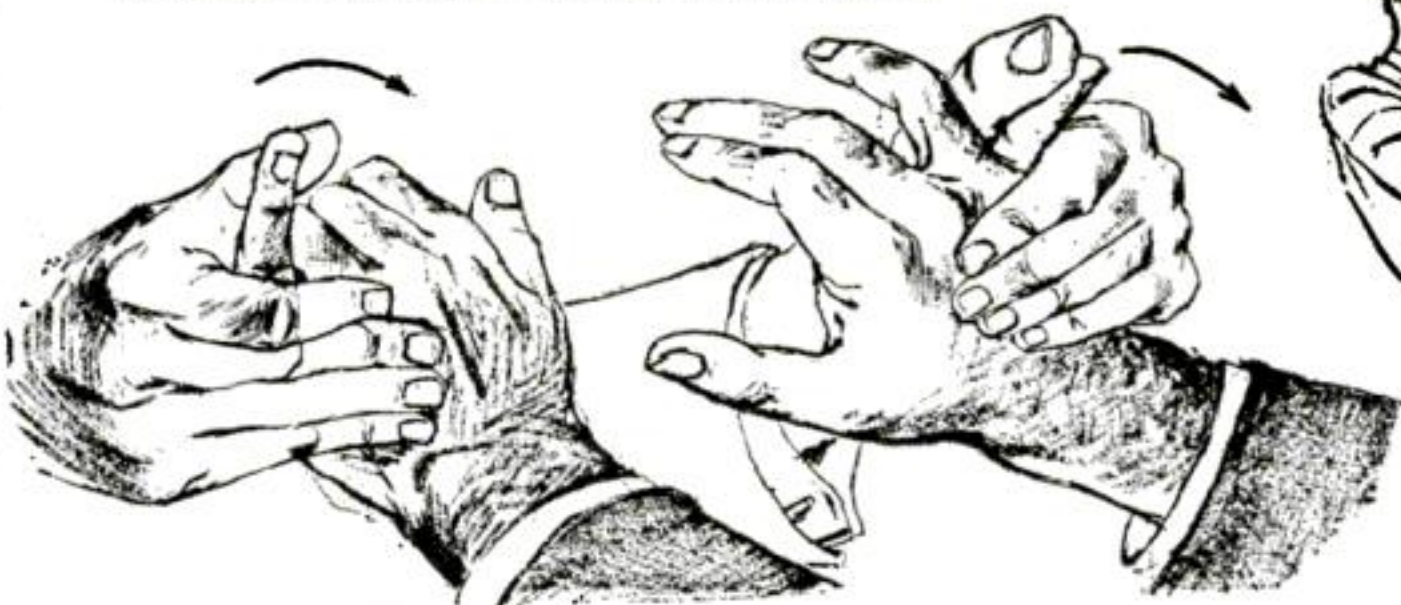
3
**BASIC
ARM
LOCK**



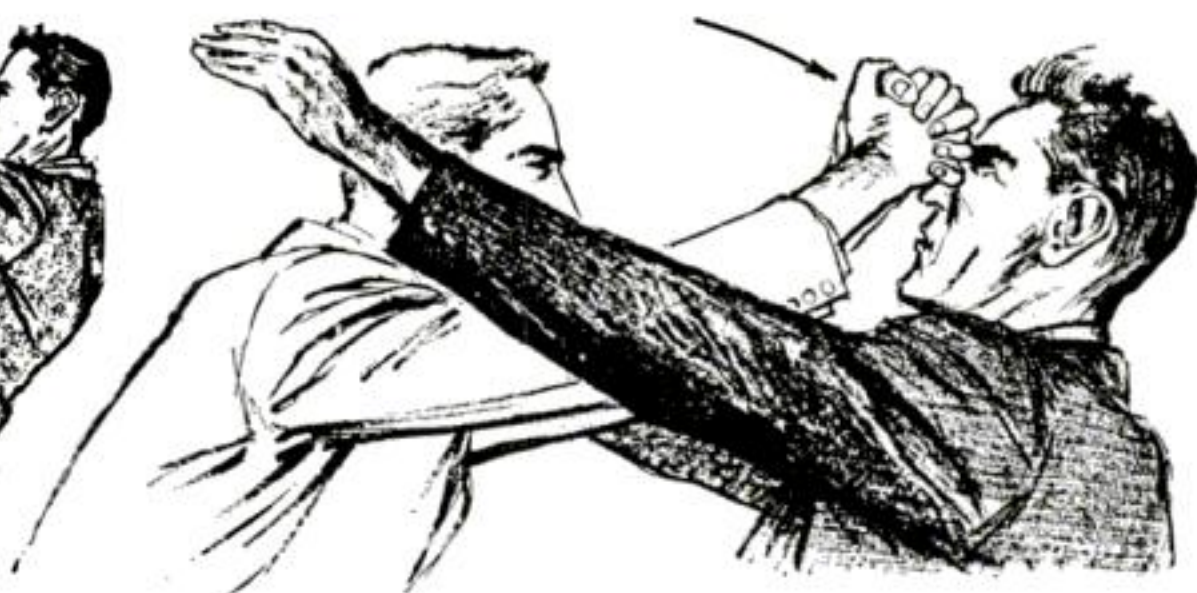
GRASP THE THUG'S RIGHT FOREARM with both your hands (left). Holding his right wrist firmly with your left hand, slip your right thumb under his right palm and pull his arm toward you to insure that it is straight (above). Then, pivoting on your right foot, turn right, letting your left elbow slide over the thug's right elbow. Keep on turning until you are almost at your assailant's side (right).

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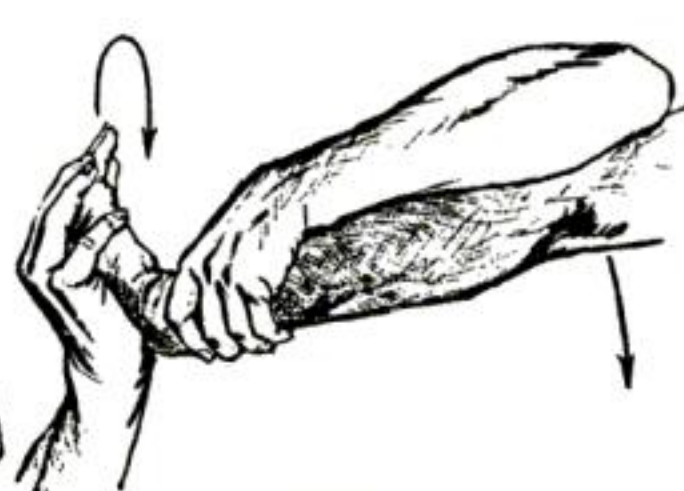
against chokes from the front



GRAB THUG'S LITTLE FINGERS, with your thumbs under their tips. The knuckles of your index fingers should be over the second joints of his little fingers (above). Move your wrists in a circular motion down toward your hips. Applied pressure will force the thug to his knees to avoid broken fingers. As he goes down, strike him in the face or jaw with your knee (right).



FIRST, CLASP YOUR HANDS (far left). Then, with fingers locked and elbows bent, swing hard from the waist and strike the thug's forearms with the bony parts of your arms. Follow through until your clenched hands are above your assailant's head and the choke hold is broken. Finish by bringing down your still-clenched hands, with all the force you can muster, on the bridge of his nose. Stop short of the nose, naturally, while practicing this.



KEEP HIS HAND ELEVATED above the level of the rest of his arm (above). Now put all the weight of your body behind your left upper arm and elbow, pushing down on his arm just above the elbow (right). Unless he submits, he will end up with a dislocated shoulder.

CONTINUED



How to break a grip from the front that pins your arms



FORCE THE THUG TO MOVE BACK by giving him a couple of sharp jabs in the groin with your thumbs. As he draws his hips back, pivot on your left foot and move your right foot across

in front of him. You should now be facing the same way he is (center). As you turn, slip your right arm behind his back and grasp his right sleeve with your left hand to keep his

How to break a bear hug from the rear



THIS DEFENSE WORKS AS WELL against an over-arm grip as against an underarm one. With your feet apart, bend your knees, stoop down, and grab your assailant's right ankle with both hands (center). Pull his ankle forward and upward to throw him on his rump (below).



*Illustrations drawn specially for
POPULAR SCIENCE by Dana Rasmussen*



body close to yours (above). Keep your knees bent slightly, maintain a steady pull on the attacker's sleeve, and keep your right hand in the small of his back. Straightening your

legs now will raise his feet off the ground. Your opponent is now balanced on your right hip, and you toss him by turning him over as you continue to pull on his right sleeve (above).

Defense against a kick aimed at face or stomach



TRAP THE THUG'S FOOT by bending your knees and crossing your hands in front of you (above). As the kicker's shin contacts your wrists, turn your left hand (top right) so that you have a firm hold around his calf. Assuming that the kicker uses his right leg, spin around to your right, throwing him forward on his face (center right). Once he's thrown, follow up by going down on the ground with him. In the final position (bottom right), your left forearm is behind his calf, your left hand is on your own right biceps, and your right hand is on top of his foot. Use care when practicing this lock; doing it jerkily could dislocate the leg.

CONTINUED

Three ways to subdue a thug who tries to choke you from behind



1 ARM LOCK



GRAB THE CHOKING FOREARM at the wrist with your left hand and place your right hand under the assailant's elbow (left). Pull down with your left hand and push up with your right, turning and bending your body as you do so. This should give you enough space to extricate your head from between your attacker's elbow and body. Bring left foot back as you turn, so you are at his side. Twist his right arm behind his back.



2 SHOULDER THROW



GRAB THE THUG'S SLEEVE at the elbow with your left hand while your right grips his shoulder (or as high up on his sleeve as you are able to reach). Bend your knees, but keep your torso upright. Bend your body forward. Pull down and to the left with your left hand, forward and slightly to the left with your right. Push your hips back against your attacker's thighs as you pull, and he'll be thrown over your shoulder.

judo clubs conduct classes for beginners.

If there's no club near you, get yourself a willing partner, a pair of slacks, a sweater, and a soft place to land. The best landing spot is a judo mat, but cushiony grass will do.

First thing you must know is how to fall. A good landing, or break fall, takes at least 90 percent of the force out of even the most powerful throw.

You and your partner would be unwise to practice any of the throws described on these pages until you know how to land properly.

Judo is not magic. It does, however, enable you to throw a man much bigger and stronger than you if you have the skill to do so. You use your knowledge of leverage and balance to down your foe. It's a great shock to a bully to be coun-



WHEN HIS RIGHT ARM IS TWISTED almost as far back as it will go, slip your left hand under his right wrist. Slide your left arm across his back (right) until your left hand is on his right shoulder and his right wrist is trapped in the crook of your left elbow. To apply the pressure part of the lock, raise your left elbow in a forward circular motion while holding your assailant's right elbow steady with your right hand.



3 SHOULDER DROP

THIS THROW STARTS THE SAME WAY as the shoulder throw. You first grab your opponent's right sleeve at elbow and shoulder. All you have to do now is drop onto your left knee, stretching your right leg sideways as you do so. Pull down with your right hand and the thug is tossed over your shoulder. This and the other throws that are shown on these pages should be practiced only on well-padded surfaces or on a soft lawn.

terattacked by a smaller guy he thinks he can easily beat up.

Don't take foolish risks with the skill you may learn here, though. If you throw an attacker, don't try to take him to the police alone. Your object is only to protect yourself. After you've beaten your enemy, call for help.

When you're ready to practice the defenses detailed here, be sure to arrange

a signal to let your partner know when you've had enough. The minute a hold becomes painful, signal: *You must do this to avoid injury.*

Each movement shown puts a powerful leverage on a limb or attacks some weak point of the body. If your efforts don't succeed, you're not doing it right.

Never apply the locks with a jerk; you may injure your partner.

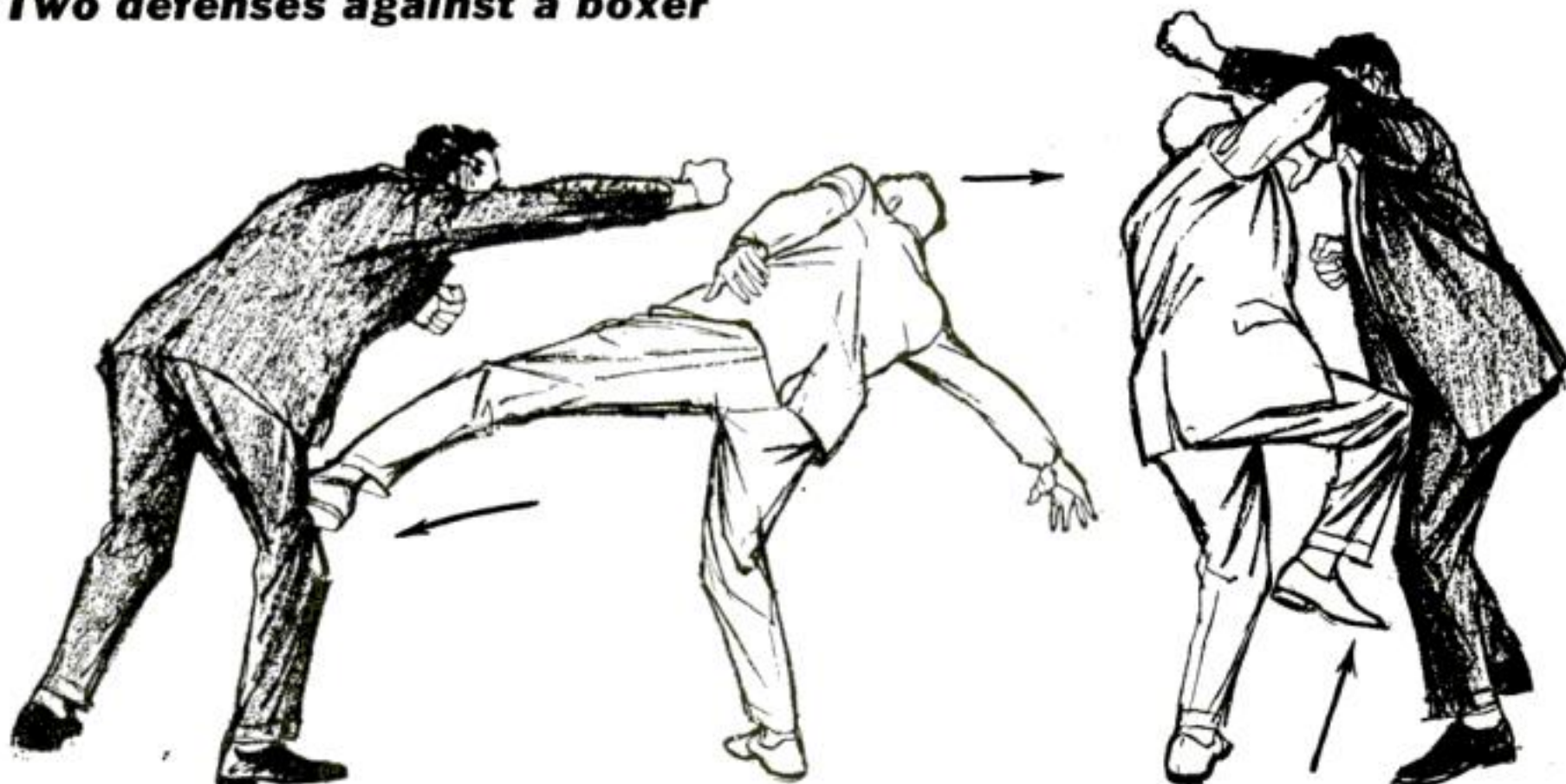
Dislodging a one-hand grab of hair



GRAB THE ATTACKER'S WRIST with your right hand. Hold his hand on your head (or throat) as you turn right and raise your left arm high (center). Bring that arm down upon your foe's

upper arm, placing your left foot in front of him as you do (right). If you do this swiftly, you may well injure your assailant. Better go slow when you're practicing it, though.

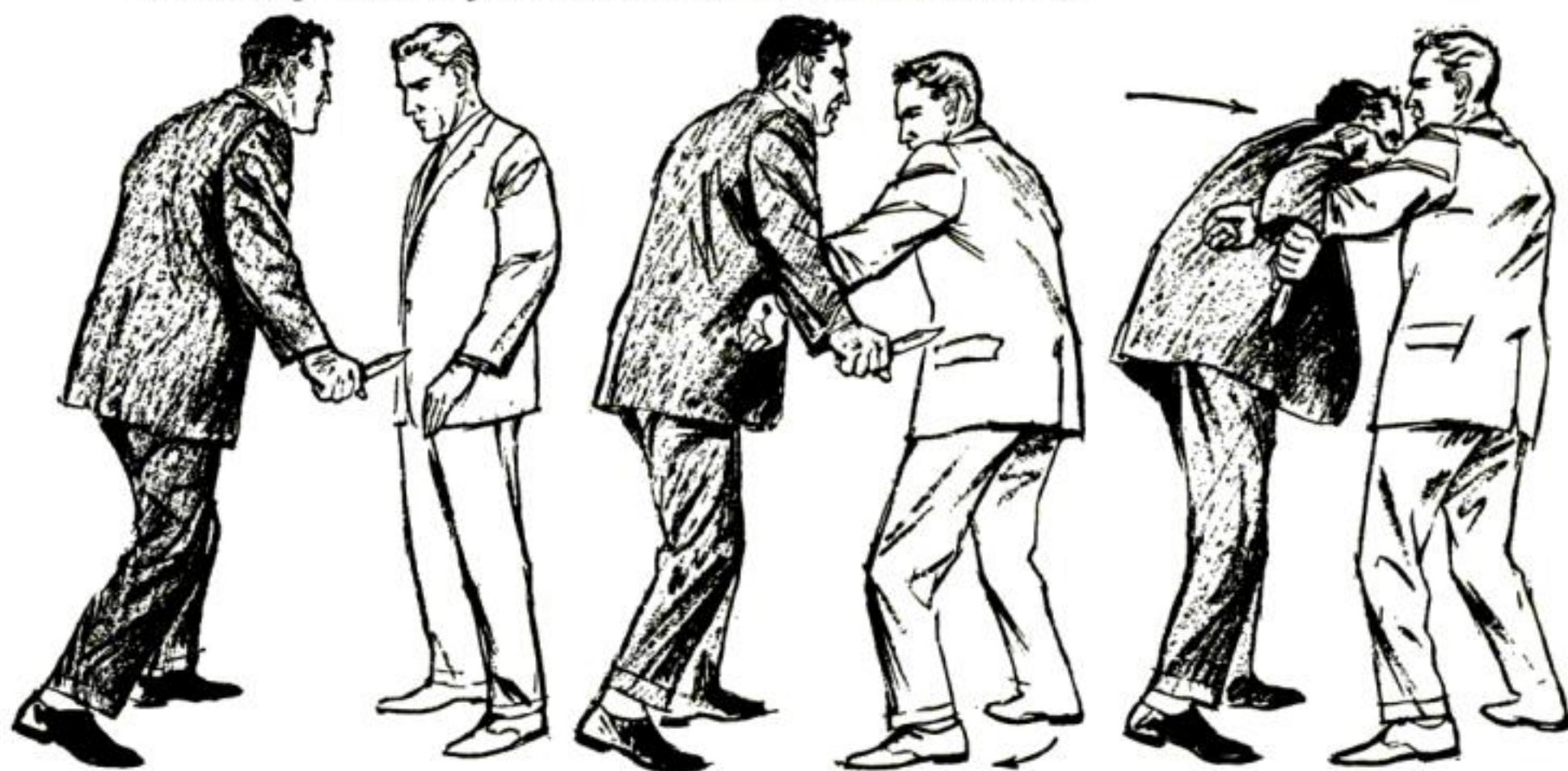
Two defenses against a boxer



AS YOUR OPPONENT AIMS A BLOW, spin to your right with your full weight on your right leg. Bend your left knee and then straighten that leg right out at the attacker, catching him just above his right knee with the sole of your left foot, backed by the full force of your body. As your left leg kicks out, jerk your head right. This counterbalances the weight being pushed left. It also gets your head nicely out of the way of the aimed fist of your opponent.

ALTERNATE METHOD is to deflect the blow with your right forearm and counterattack with a knee to the groin. Skip the knee jab, however, during practice sessions.

How to protect yourself from a knife-wielder



AS THE KNIFER RAISES HIS BLADE, parry the blow by striking his forearm with the edge of your own left forearm (center). Quickly seize his clothing near his right shoulder with your

right hand. Then, with a strong but smooth movement, pull his right shoulder toward you while also pushing his right (knife) hand upward and away from you (right).



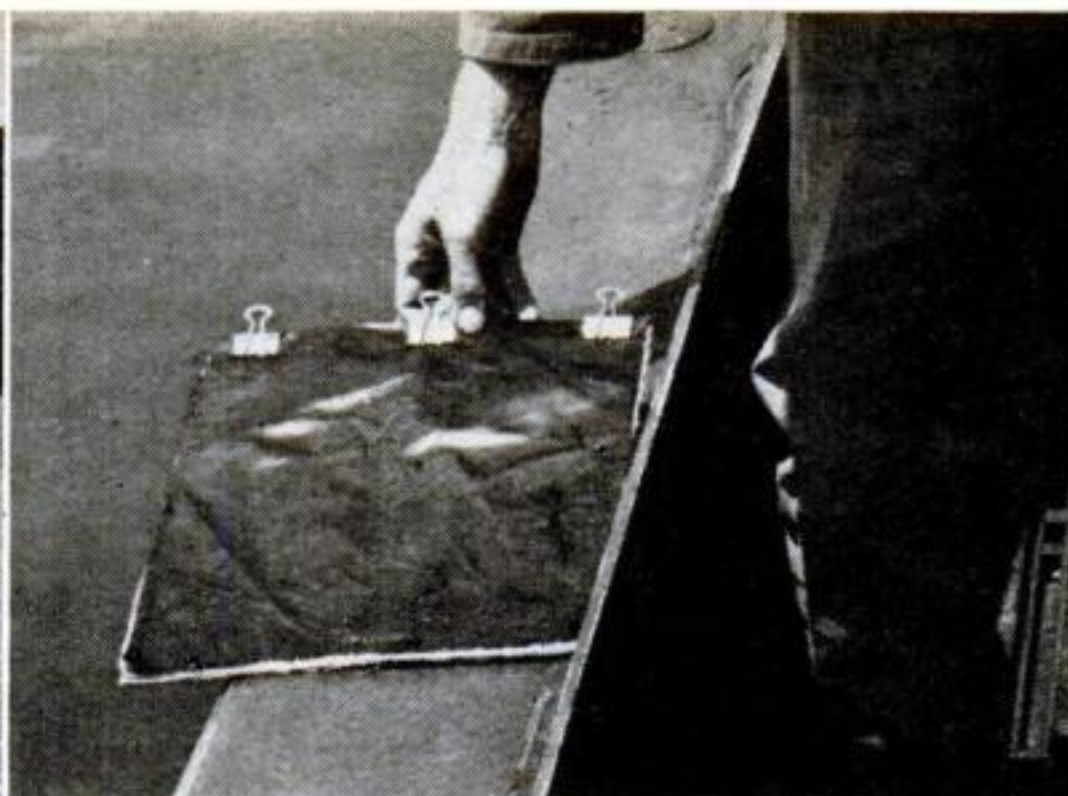
GRAB HIS RIGHT WRIST with your left hand as you push his knife hand up, while still holding on to his shoulder with your right hand (above). Now move your right hand from the knife-wielder's shoulder to his right elbow.



PUSHING DOWN ON THAT ELBOW keeps his knife arm straight. Pulling his wrist toward you applies a very drastic shoulder lock. Unless your assailant drops his knife, you can easily dislocate his shoulder. ■ ■



Dip it into sea water . . .



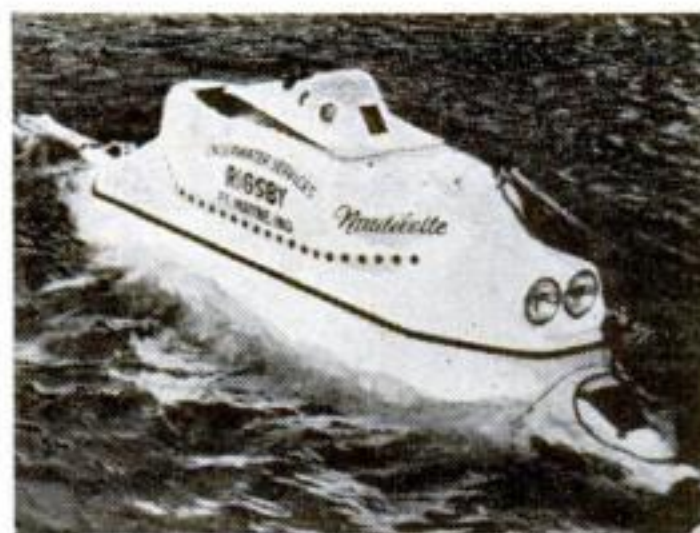
. . . place it in the sun . . .

Thirst quencher for shipwrecked military men

The Army has developed a simple salt-water still that will make enough fresh water to keep a sea-disaster survivor alive while waiting for rescue. It consists of a sheet of black plastic film, a

piece of paper toweling or cloth, a water-repellent screen, a sheet of aluminum foil, a cloth backing, and a sponge.

Dipped into sea water and placed in the sun with the plastic film up, the



Two-man submarine

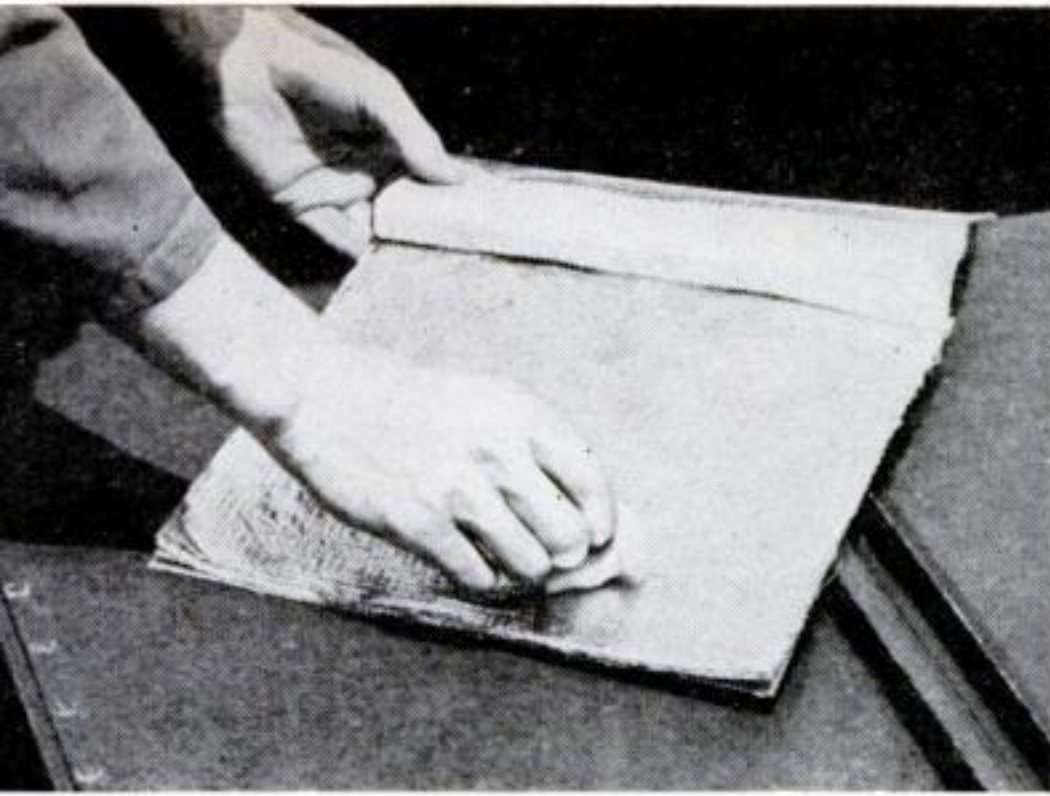
This little submarine carries two men on sea-bottom explorations and salvage work on the Great Lakes and nearby waters.

It's powered by batteries under the water, by a gasoline motor on the surface.

Marines to walk tall

Six-inch wedges of stainless steel have been designed to be worn under the soles and deflect fragments of exploding land mines away from Marines.

The armored boots on the Marine at left were developed by Naval Medical Field Research at Camp Lejeune, N. C., will be issued next year.



... sponge up water condensation ...

aluminum foil is heated from above and cooled from the water-soaked cloth below, collecting a condensation of fresh water. This can be mopped up with the sponge and squeezed into a cup.

With additional sheafs of toweling, screen, and foil, a thirsty man can get



... and squeeze into a cup.

about a pint of water in 16 hours. The still's inventor, Dr. Clyde S. Barnhart of the U. S. Army Engineer Research and Development Laboratories at Fort Belvoir, Va., calls it a "sit still"—a sea victim lacking sunlight can sit on it and distill fresh water by heat from his body.



Drill mixes concrete

British do-it-yourselfers can mix their own concrete in the new machine above with no strain on their backs. Rotated by a $\frac{1}{4}$ -inch drill, it will prepare 50 pounds in two minutes.

The drum can also be turned by hand. It tips for dumping, and can be removed and a wheelbarrow body fitted in its place.



Land-Rover has tractor conversion

Bolt-on tracks make the four-wheel-drive Land-Rover a cross-country crawler equally at home on sand, snow, swamps, or 45-degree slopes. Power-steered, it makes 35 m.p.h.

Each wheel is replaced by a triangular assembly consisting of four ordinary car wheels paired like the trucks on a railroad car and a sprocket that fits on the axle to engage track shoes on a reinforced rubber belt. Outer walls of the dual tires are protected by metal disks on the belt.

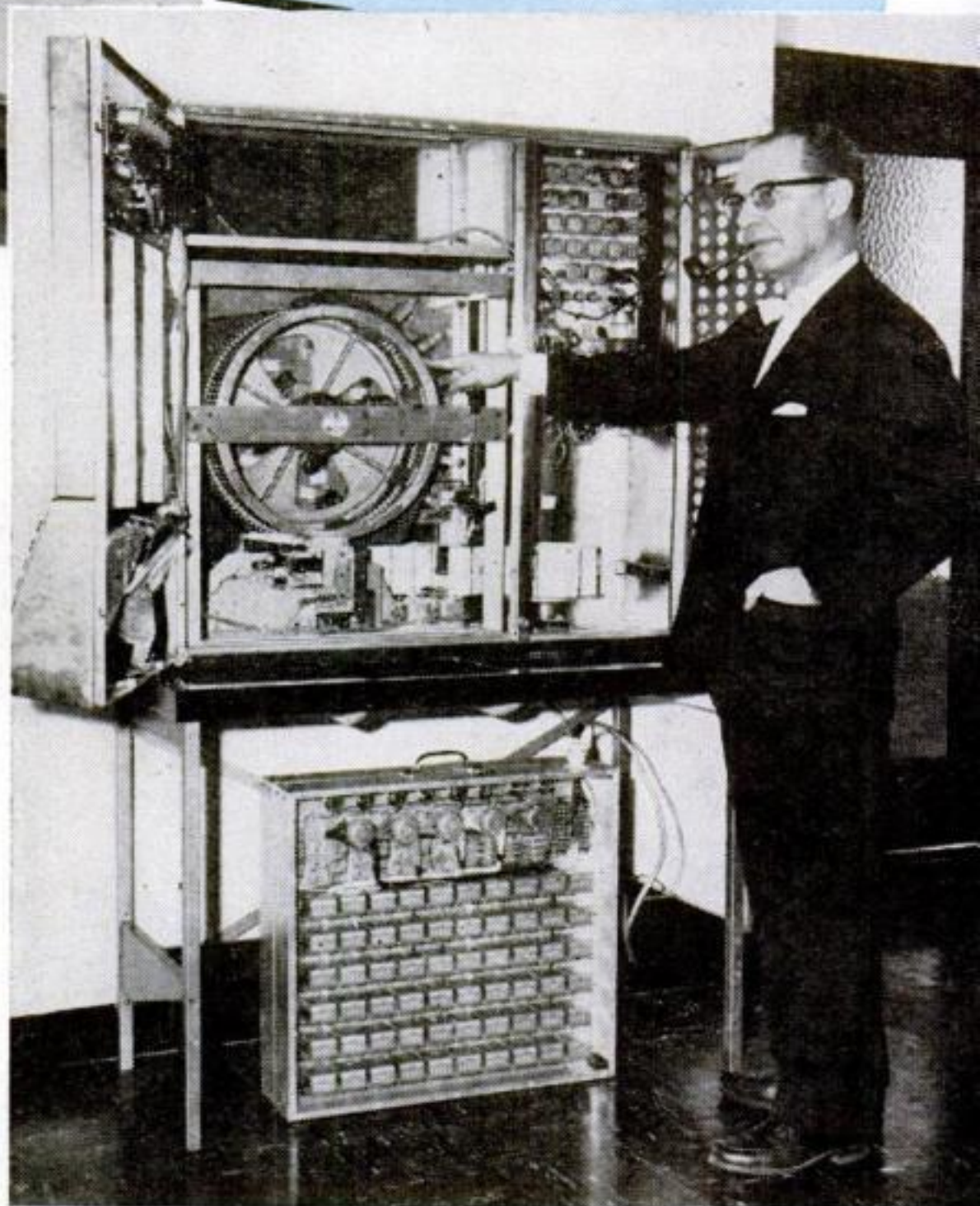


INFORMATION BY AUTOMATION: Press buttons on this machine at a service station on the N. J. Turnpike, and you get a free trip slip (like the one at top right) detailing your route.

Now it's instant information:

Robot Tells You Where to Go

WHEEL-MOUNTED MEMORY BANK turns, picks out needed information; mechanism prints it on the spot. Dr. Max Tamir created automatic director after getting lost in Brooklyn subway. Polling unit, on floor, keeps count of questions.



51. Take Exit 18 and go West 3 miles on Rt. 46 to the intersection of Rt. 17, down ramp & continue on Rt. 17 for 12 miles to the Thruway at Suffern, N.Y. Speed Limit on Rt. 17 is 50 mph.

DRIVING North on the New Jersey Turnpike, you roll into a service station near Woodbridge and ask the way to a New York airport.

"A machine inside," says the attendant, "will give you printed directions."

On a wall is an alphabetical list of places and major highways, from Aqueduct Raceway to Zoo, Bronx. You press the button with the number of your destination.

A sign lights up: "Machine in operation." In seconds a slip of paper drops out. It tells you the route you'll travel, and lists any exits, highway numbers, forks, and traffic circles that concern you. It may warn you of a lower speed limit on some stretches; or ask you to press another button for directions to an in-

termediate point or highway, and then tell you how to go on from there. You pay nothing. The trip slips are yours to take along.

Road queries at this Cities Service station are so heavy that the company employs uniformed girls to take the load off gas-pump attendants. Now the Directomat, first machine to give highway information, not only eases their job but stays on duty after the girls go off.

Getting lost in the subway is what started Dr. Max M. Tamir, a city-planning expert, thinking about travel guides. His first idea was a chart of subway destinations and the routes by which they can be reached (85 answers, he found, covered all possible queries at the subway hub of Times Square station).

But a chart wasn't enough, Dr. Tamir knew. People rarely had the means of writing directions down, would forget what they had read. The idea of a machine that would issue written directions grew on him. Today his Directomat stands at Times Square station.

In other locations, it gives facts about new buildings, products, or professions, informs convention visitors about programs and amusements, answers questions about bus and airline travel.

A modest, soft-spoken man who was a member of the French underground at one time, Dr. Tamir shrugs when credited with inventing the machine. "I had much expert help," he says. But it was he who saw embossed addressing plates as the solution to printing information on the spot. They cost little, can be changed in a jiffy when information is obsolete. Hung on rods around a wheel are 120 such plates.

Push a button and the wheel turns, the plates flipping over as they crest the downward-turning side. A network of relays and solenoids stops the wheel with the stencil bearing the desired information at the bottom.

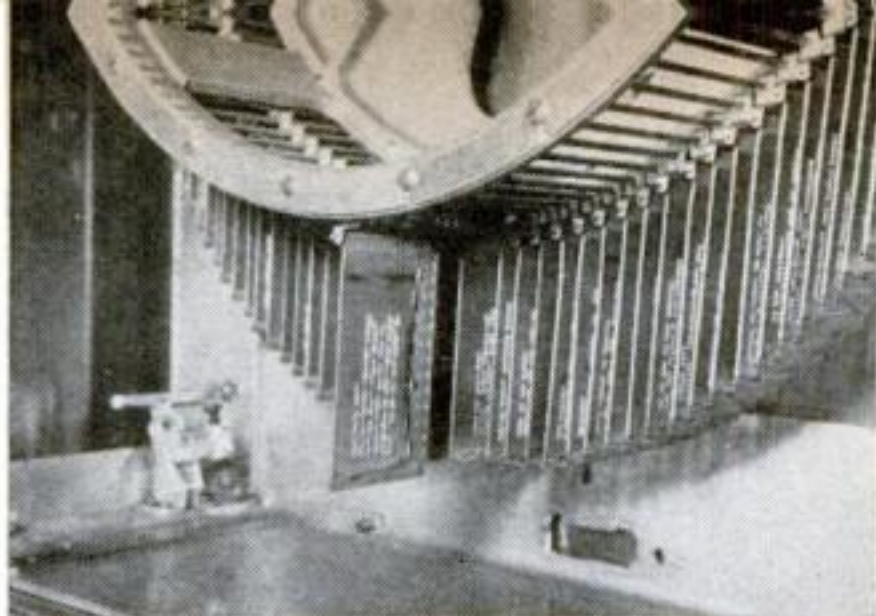
Permanent magnets hold it in line with an upright arm. The arm, moved by an electromagnet, in turn moves the plate out of the storage line into printing position before a platen. The sequence timer now energizes another magnet that shoves the platen and plate against an inked ribbon with the paper behind it.

The platen backs off, the upright arm returns, and a spring arm slides the plate back into line as a motor pulls the paper through one frame width. Finally, another magnet yanks down a cutter and the trip slip tumbles out.

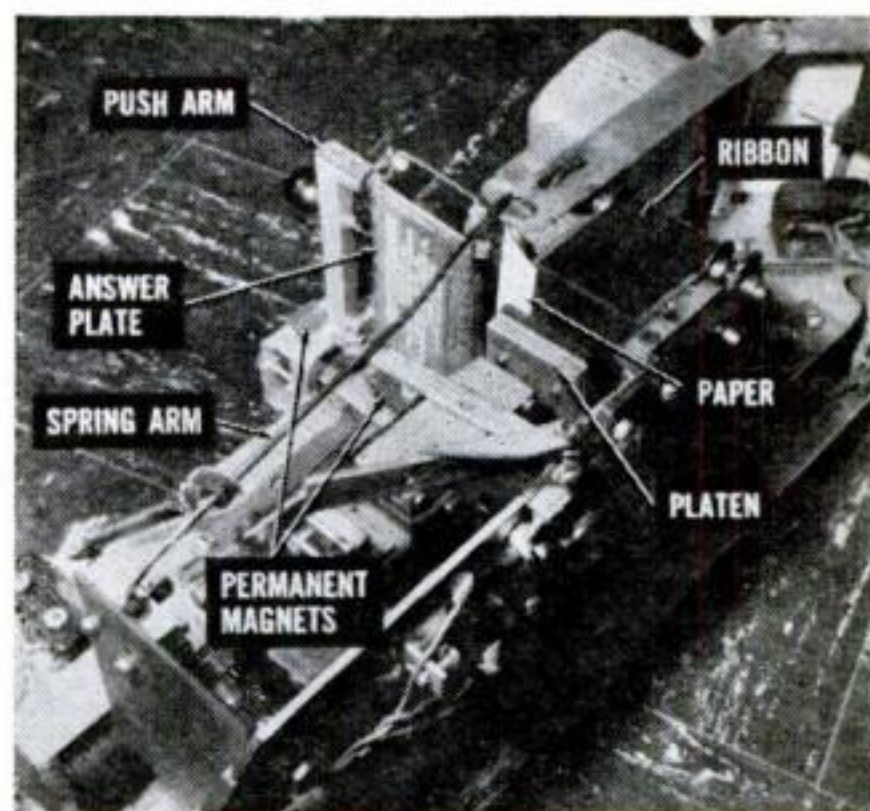
It works fast; average time after you punch a button is 10 seconds. It varies with the position of the desired stencil in relation to the last one used, which determines how far the wheel must turn.

What happens if you push two buttons at once? "It can't be done, electrically speaking," says Dr. Tamir. "You'll always push one a millisecond or so ahead of the other."

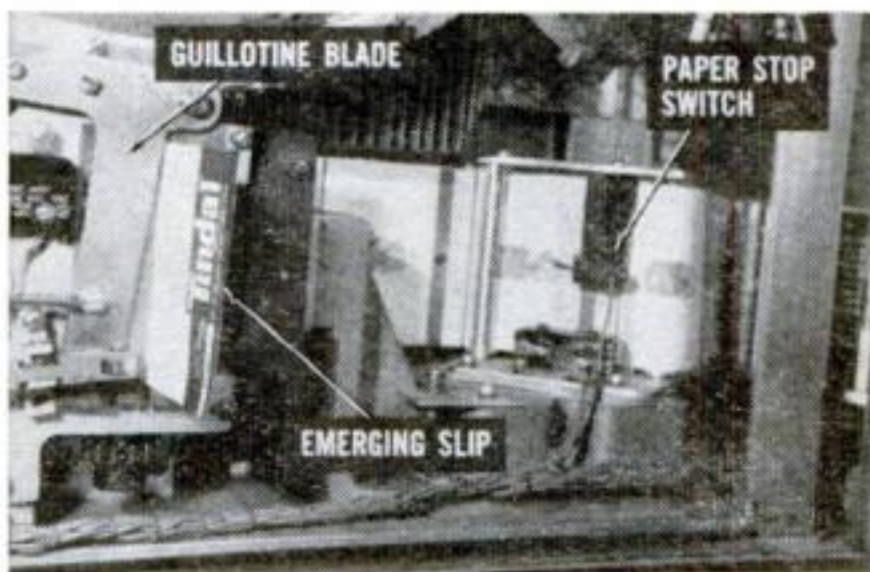
A device can be attached to the Directomat to keep tab on questions asked. It shows up those ignored and which are more popular.—*Harry Walton.*



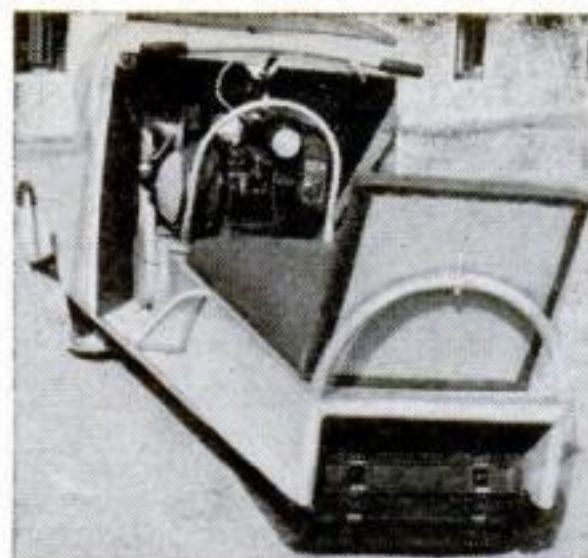
EMBOSSSED ANSWER PLATES are hung around the wheel on horizontal rods. Studs on the wheel trip microswitches to select one of four quadrants, then one of five sectors in that quadrant, finally one of six plates on that sector, stopping wheel with the right plate at the bottom. Another mechanism (not shown here) slides it out like this for printing.



TWO PERMANENT MAGNETS steady the swinging plate. A push arm slides it between the platen and a wide, inked ribbon. The platen then pushes it against the ribbon and the paper behind, printing its embossed message there.



AS THE PUSH ARM RETURNS, a spring-tensioned lever slides the answer plate back into the memory bank. Paper tape is motor-driven until a contact arm closes a circuit through a hole in the paper, so stopping it when the printed slip has emerged. A guillotine blade then slices it free. Next question?



ENGINE UNDER COWL is 4-cycle, air-cooled, 1-cylinder, 7-hp. Kohler K161. It burns a half-gallon of gas an hour at top speed of 25 m.p.h. Back rest is for second rider with feet propped on running boards.

Skis and tractor combined for riding on snow

With skis in front for steering and an endless track supported by five sets of wheels and driven by two sprocket wheels, the rugged little vehicle pictured above is built for cross-country driving on snow. Its 7-hp. engine will push it at speeds up to 25 m.p.h.

Smallest and newest of tracked snowmobiles, it sinks less into new snow than a man on snowshoes. It's used by sports-

men, trappers, missionaries, prospectors, surveyors, and telephone linemen.

Ski-Doo is 106 inches long (72 without skis), 30 inches wide, and 32 inches high with windshield off. It can be packed in a station wagon or, with one bolt in each ski and the seat back removed, it can be stowed in a car trunk with lid up.

Bombardier Snowmobile, Ltd., Valcourt, Quebec, sells it for about \$850.



Bayonet trainer fights back

A boxing glove on the end of this training machine parries, blocks, jabs, and slashes back as a Marine tries to get through its guard with his bayonet. It's operated by an instructor on the control end of its swiveling stick.

The prototype shown in action here is built of wood, but future trainers will be all metal.



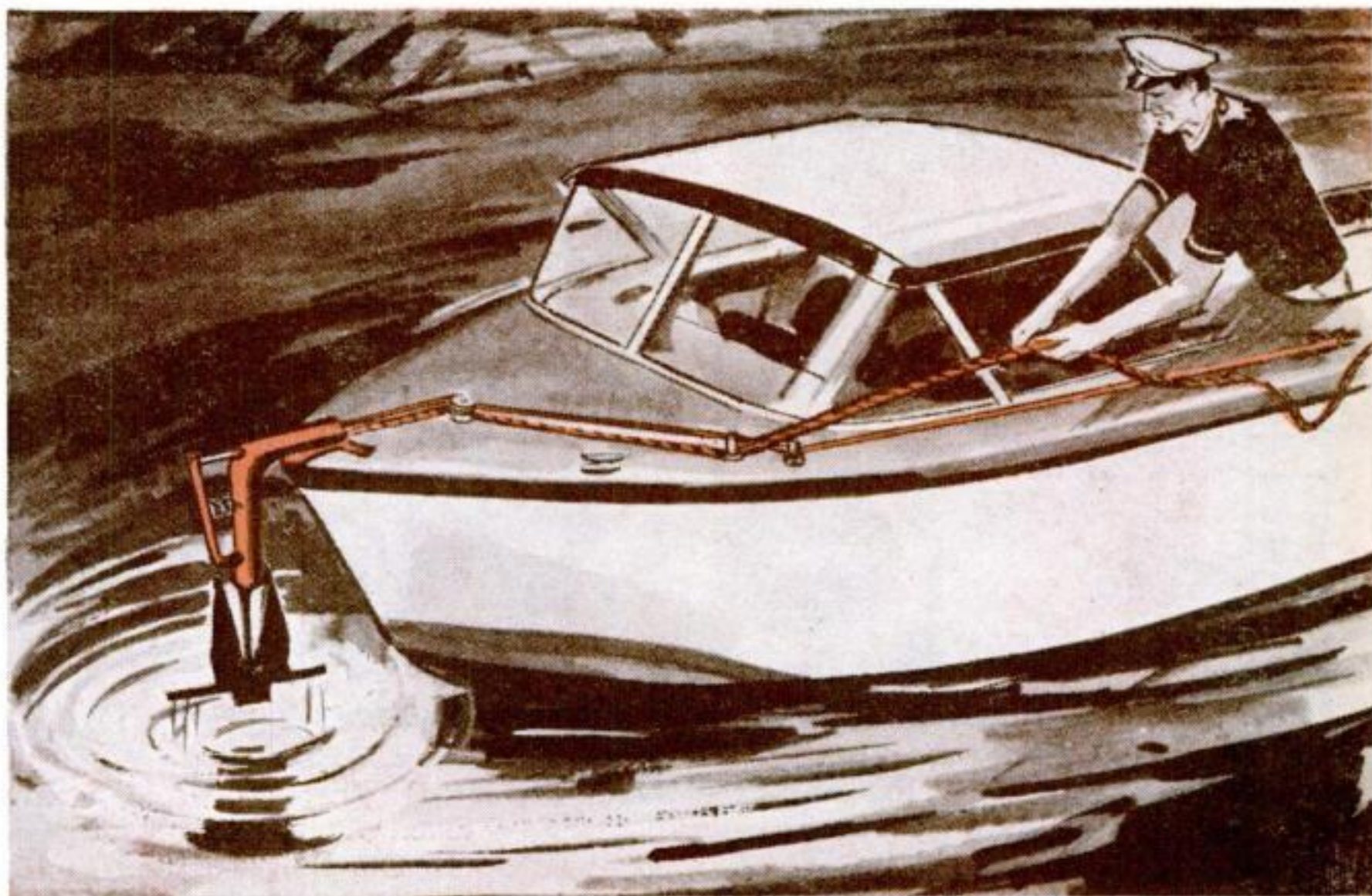
Coin-operated shaver

A quarter will get you a four-minute shave from the latest vending machine. The Shav Air rotary shaver works on compressed air instead of electricity.

Put it to your face, and suction lifts the beard for contact with the blades, pulls clippings into a disposal chamber inside the cabinet. When you finish, the shaver retracts into the case and is sterilized by treatment with ultraviolet rays.

New Ideas from the Inventors

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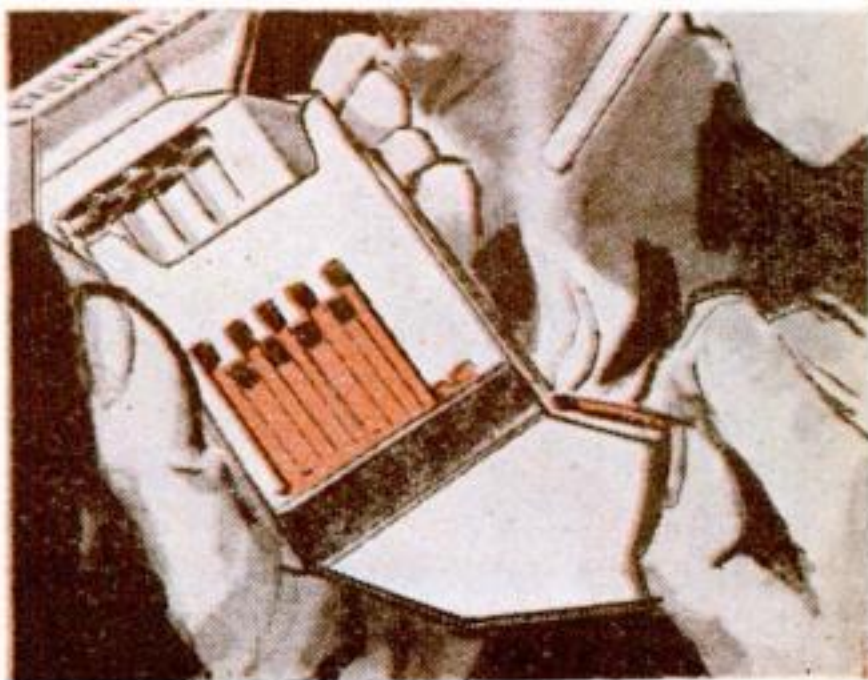


Anchor Line Lends Skipper a Hand. One man could handle a cruiser's controls and its anchor without scrambling back and forth if he had this recently patented

holder mounted on the foredeck. To anchor, he'd pull a cord that released a spring latch; pulling a second cord would raise the anchor into its sway-free sheath.

Wiper Cleans Entire Windshield. With this wiper system, one long strand of rubber, attached to blades at each end, would sweep down the full width of the windshield from top to bottom—providing better vision in cars with big, compound-curve windshields. The blades would be synchronized to move together.

Cigarette Box Holds Matches. To add matches to a crushproof cigarette box without adding much bulk, this inventor suggests a staggered, single row of matches. They'd be attached under an extra front flap that would drop when you lifted the lid. The striking surface could be placed anywhere on the box.



CONTINUED

III

More Inventors' Ideas



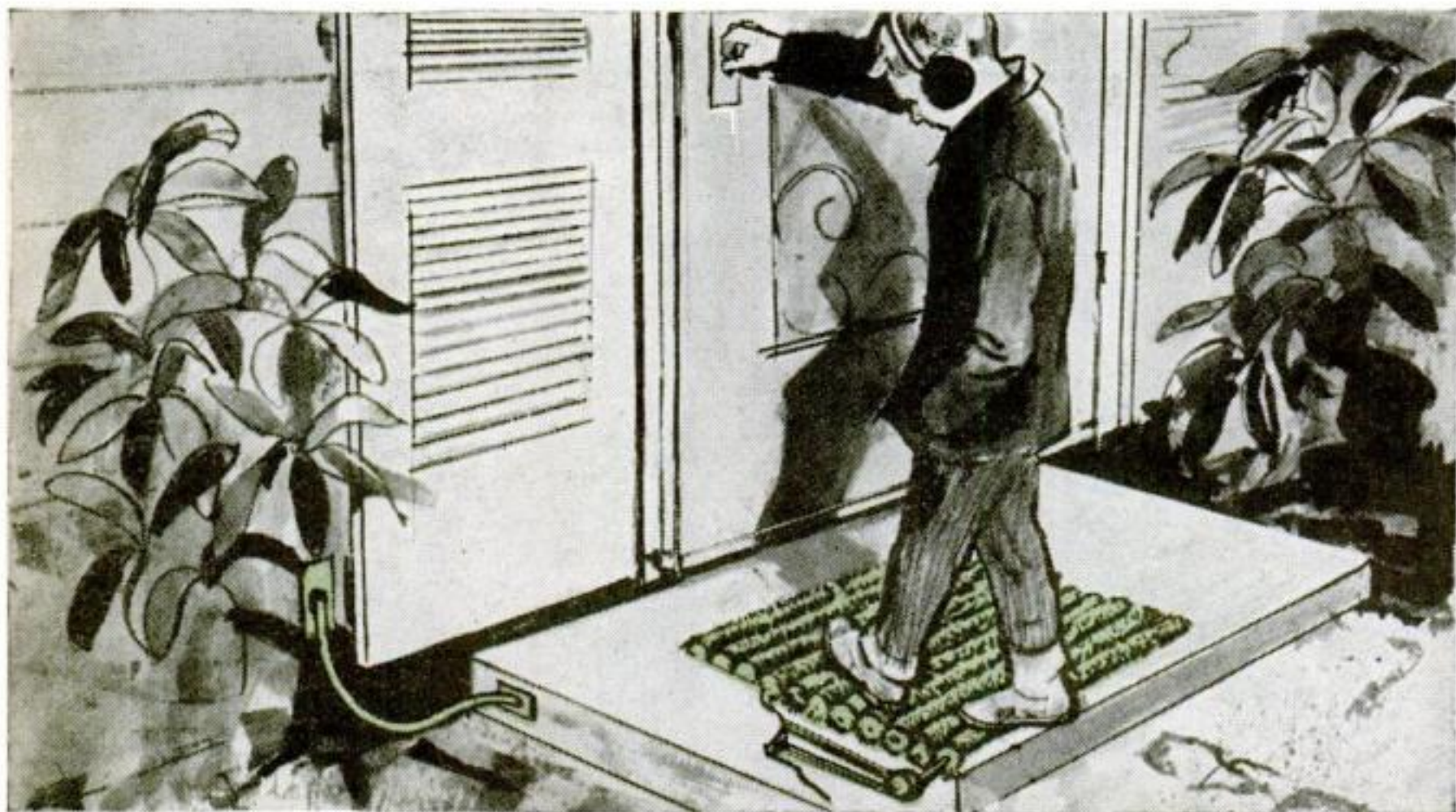
Tread Changes with the Season. One set of tires might do the work of two if they were center-grooved, like this, to take a regular or a snow tread with removable metal projections for ice. To change a tread strip you'd deflate—but not remove—a tire. Inflating the casing would lock the tread into its groove.

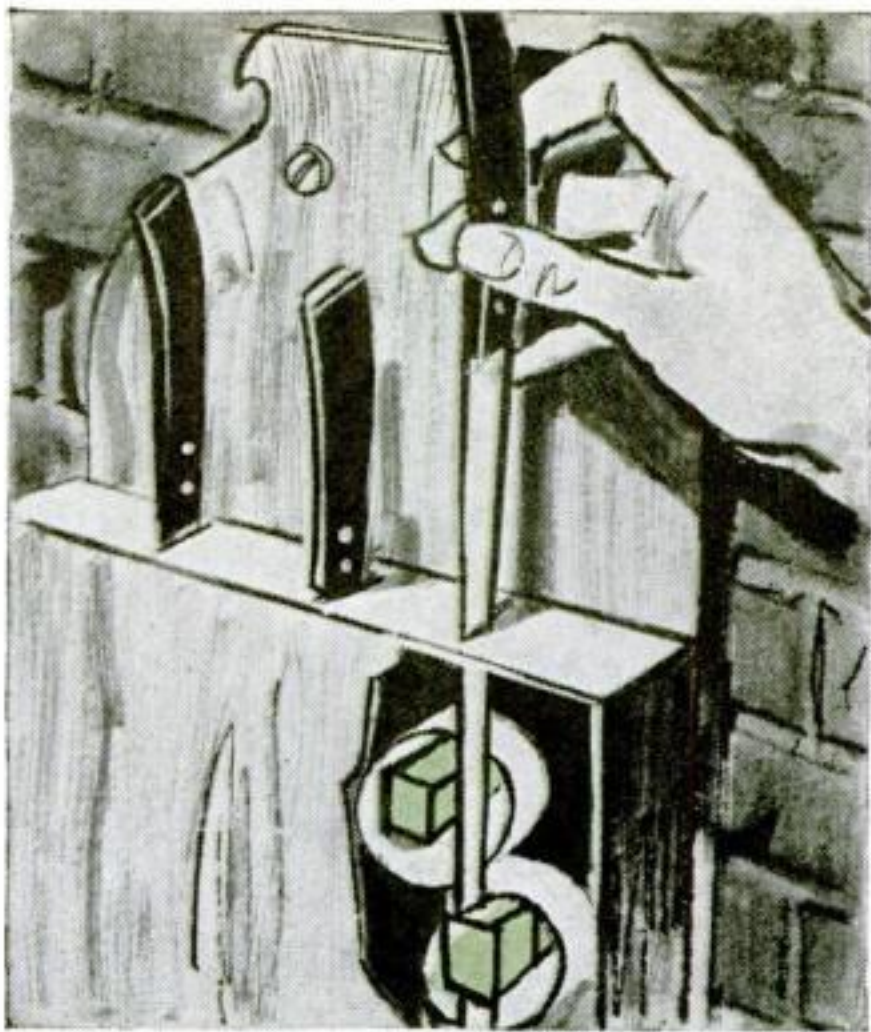


Shelf Keeps Tackle Handy. Ever kick a tackle box or watch it skate across a boat, spilling small gear? Fixed to this base, it could be anchored in easy reach. One lug would grip the box, another would lock it to the boat. Legs would level the base so you could set it on any flat surface ashore.

Electric Mat Gets Shoes Clean. Even the kids couldn't get past this automatic doormat to track dirt into the house. The weight of anyone stepping on it would

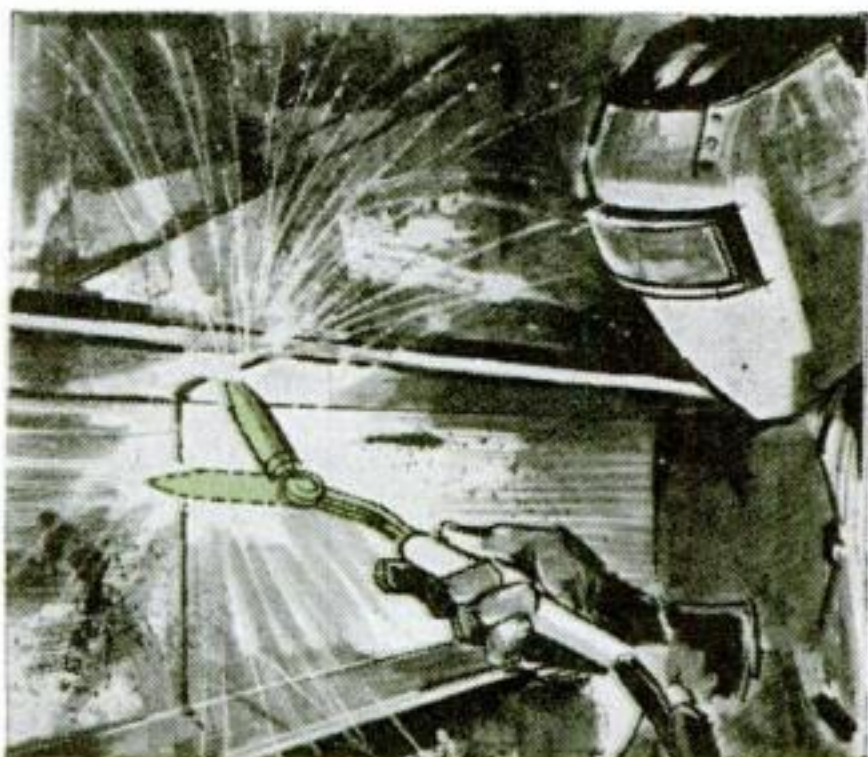
switch on a motor belted to a series of brushes. A gentle upward flow of air and revolving brushes would sweep mud and dirt from fancy pumps or heavy brogans.





Rock-'n-Roll Sharpener. A new rack to hone knives as you slip them in or out relies on pivots for efficiency. Inserting the blade would swing paired abrasive blocks in opposite directions and rock them to the proper angle to bring the cutting edge of the blade against the convex surfaces of the sharpeners.

Torch Tip Adjusts to Work. A welder often has to twist his arm to follow changing work angles. He could eliminate that if he had a torch like this one. Passages formed in a universal coupling would channel rigid gas and coolant lines from the handle to the tip. But the electrode-holding collet could be re-angled, says the inventor, by applying pressure to the end of the electrode.



Halyard Hoists Flagpole Sprayer. With this hinged spray booth clamped around the pole, a flagpole painter wouldn't have to climb to his work. Two electric guns would spray paint as he lowered the spray-catching cage, and brushes at top and bottom would smooth and spread it.

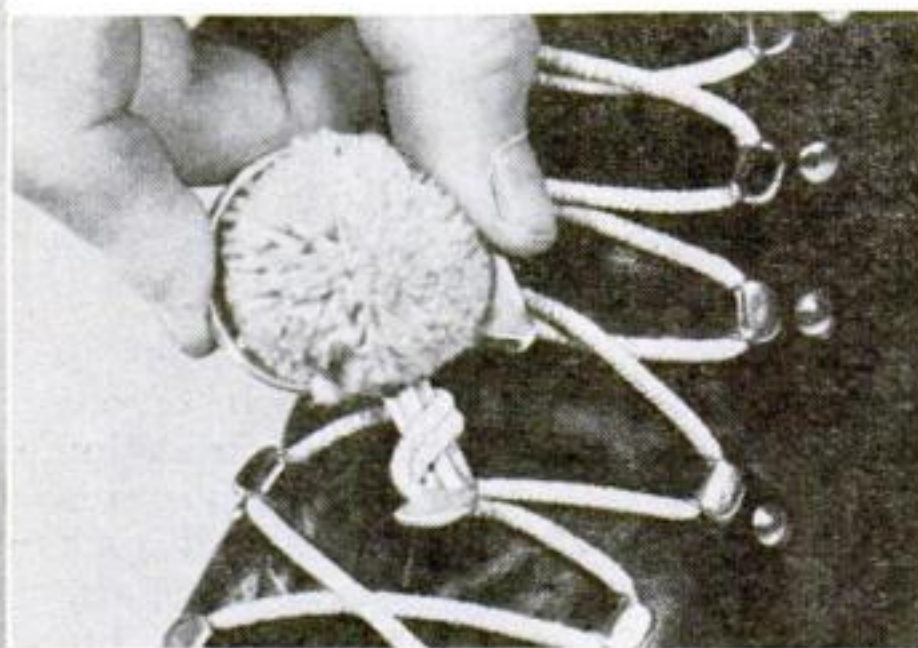
The following patents have been issued on these inventions: Anchor control—No. 2,893,341 to W. G. Anderson, Kennedy, Minn.; Windshield-wiper system—No. 2,896,245 to Leo Hopponen, Livingston County, Mich.; Match pack—No. 2,894,619 to Alfredo Gallo, Miami; Tire—No. 2,953,181 to Carlo Barassi, Milan, Italy; Tackle-box support—No. 2,893,673 to Laddo Maly, Anderson, Ind.; Mat—No. 2,895,159 to H. J. Ostrow, Palatine, Ill.; Knife rack—No. 2,893,178 to J. E. O'Riordan, Mission, Kan.; Torch—No. 2,986,624 to M. S. Marta, Tarzana, Calif.; Spray painter—No. 2,998,801 to A. F. Edelberg, Cleveland.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.



Tourniquet keeps laces on ski boots tight

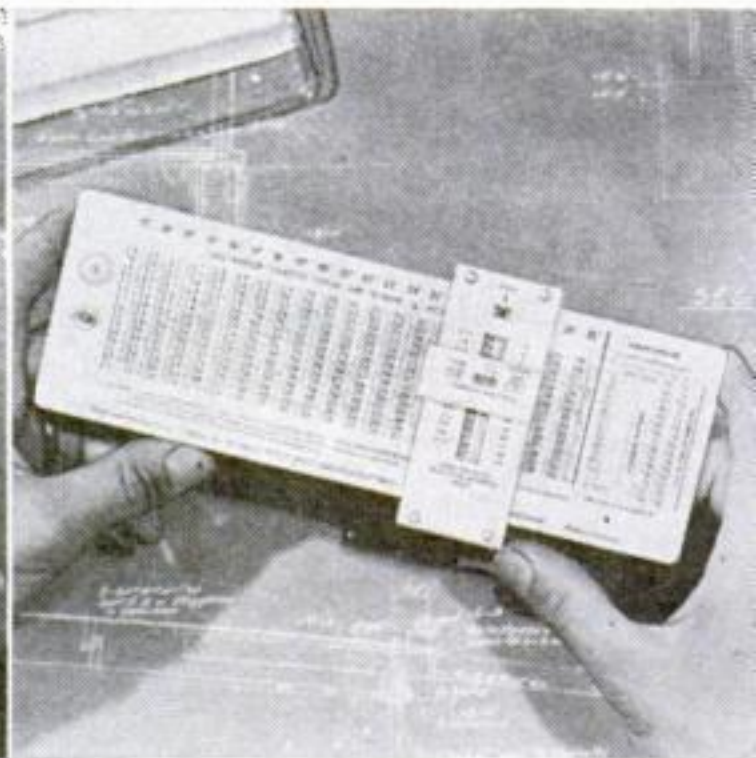
You can keep ski boots, skates, and hunting boots laced tight by twisting a hooked aluminum bar in each and leaving it in place. Loosen, if you wish, when you rest. Red or gold pompons on one end are decorative for sport wear. Titans, \$2.95 a pair from Carmel Titan Corp., 9 Fair St., Carmel, N. Y.

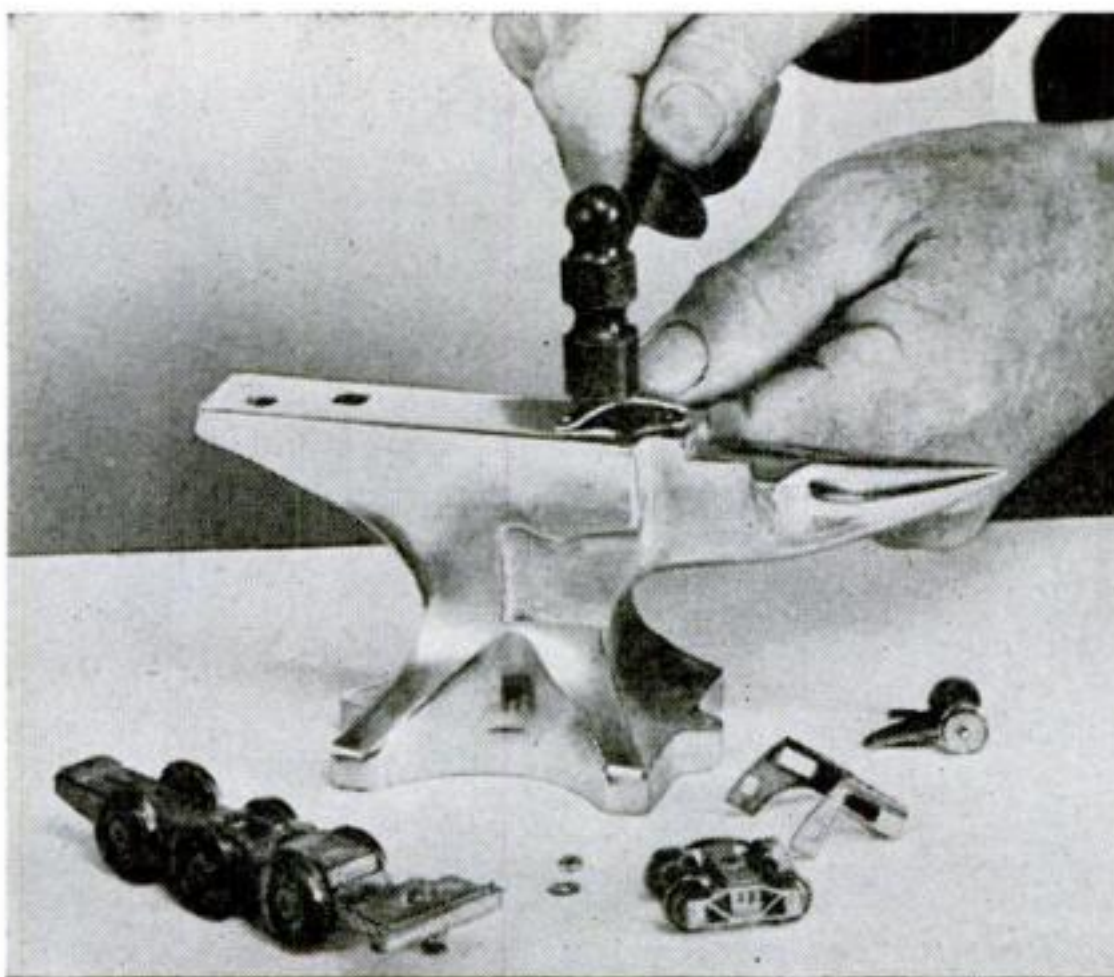


PRECISION GUIDE is part of kit that will turn your router into an accurate veneer trimmer. Screw its face on router base, insert special bit, adjust, and lock. For $\frac{1}{4}$ - to $\frac{3}{4}$ -hp. routers, \$15.95; larger, \$16.95. Stanley Works, 195 Lake St., New Britain, Conn.

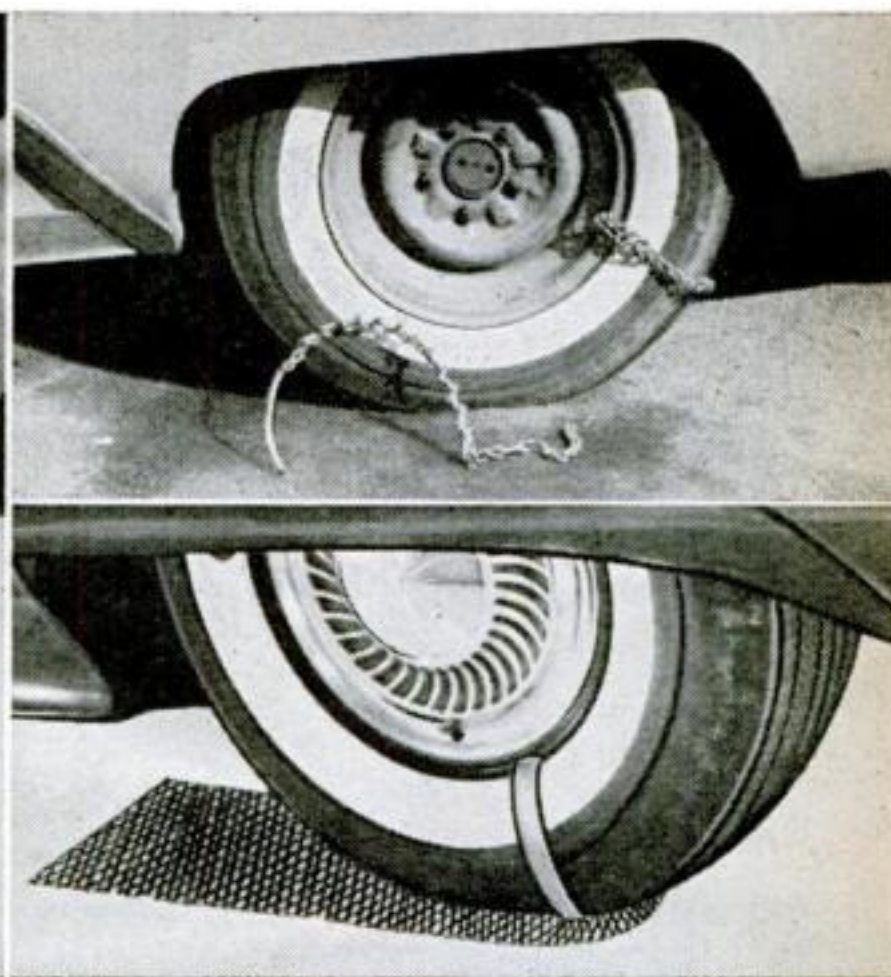


COMPUTERS CALCULATE LENGTH OF RAFTERS, telling you how long to saw common, jack, hip, and valley rafters for given span and pitch. Dial-a-Length Rafterule (left) is an assembly of plastic disks; Plumas Rafter Calculator (right) is an aluminum slide rule. Set index windows of either for span and pitch, and you get length of rafter automatically. Other information includes angle of plumb and side cuts. Dial costs \$4.95. Emmert Products Co., Box 221, Sycamore, Ill. Slide rule is \$7.75. Price & Rutzebeck, Box 30, Hayward, Calif.





MINIATURE ANVIL is 7 inches long, weighs 2½ pounds, and is hard-chrome plated. Hardy and pritchel holes are copper lined. Said to be the smallest tool of its kind, it's made by oldest U. S. anvil works for hobby, model-railroad, or small-parts jobs. \$5.95. Fisher & Norris, 301 Monmouth St., Trenton, N. J.



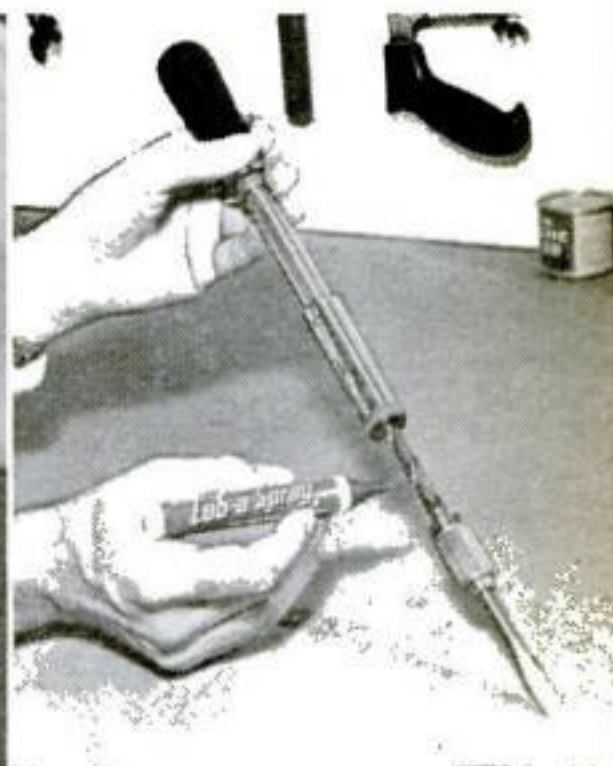
EMERGENCY TRACTION AIDS get you out of snow, ice, or mud. Top chains are for slotted wheels. Push wire through slot and link, then clip. Steel clamp on mat below snaps on rim. Chains, \$3 pair. Quality Metal Products, 12 Newhall Ave., Saugus, Mass. Mats, \$3.50. Frabo Corp., 2011 E. 75, Chicago.



BATTERY CHARGER gets you started in 10 minutes, provides full charge in 3 hours. Plugged into house current, it charges 6- or 12-volt battery through cigarette lighter or at terminals. \$56.25. Electro-tone Laboratories, 1713 N. Ashland Ave., Chicago.

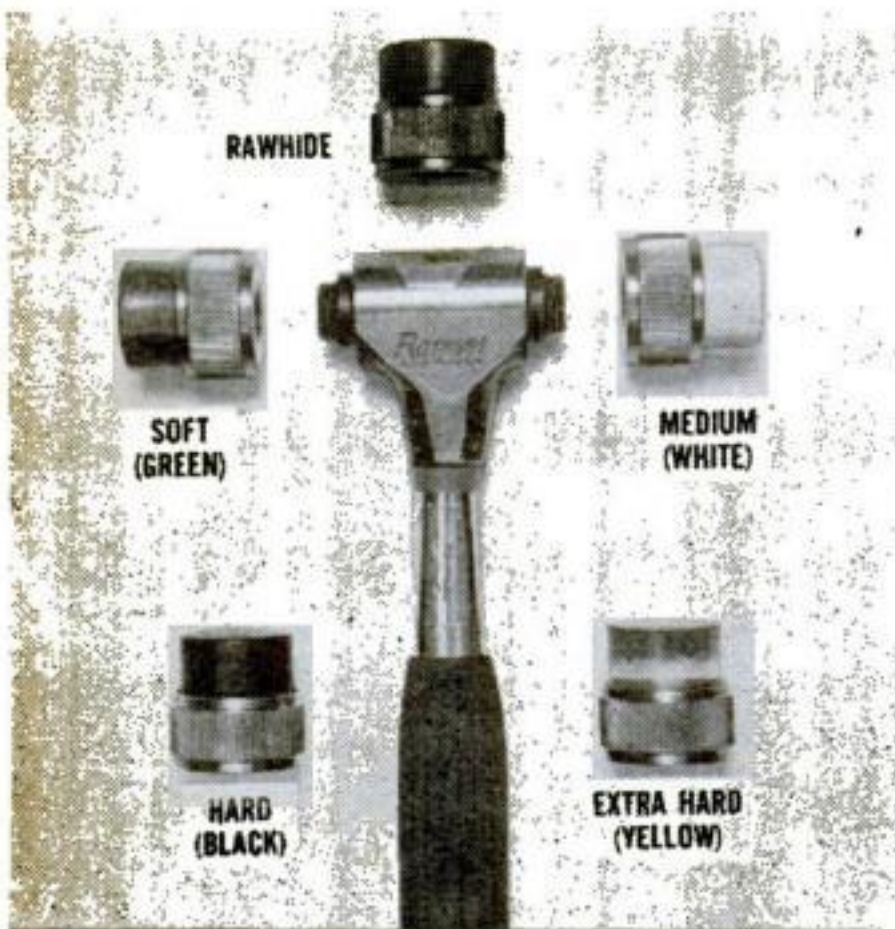


TIME-DELAY SWITCH can be set to turn light off in 5 to 15 minutes. You mount it above wall switch, cock mechanical plunger to time desired. It's useful for driveway, bedroom, nursery, and other lights. \$2.95. Bracken Co., 13576 Davenport, Pacoima, Calif.



ONE-DROP LUBRICANTS come in squeeze containers made by Extruded Plastics, Inc., Norwalk, Conn. You get a drop with a light squeeze, a stream with firm pressure. Shown is graphite applicator. Depending on type, 29-69 cents. Panef Mfg. Co., Milwaukee.

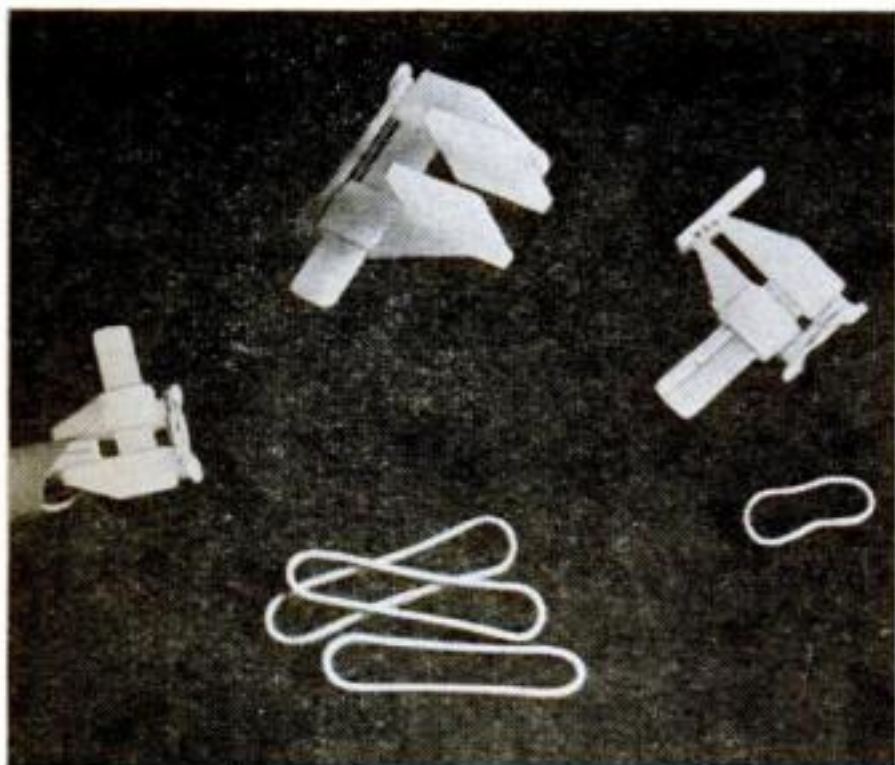
WHAT'S NEW



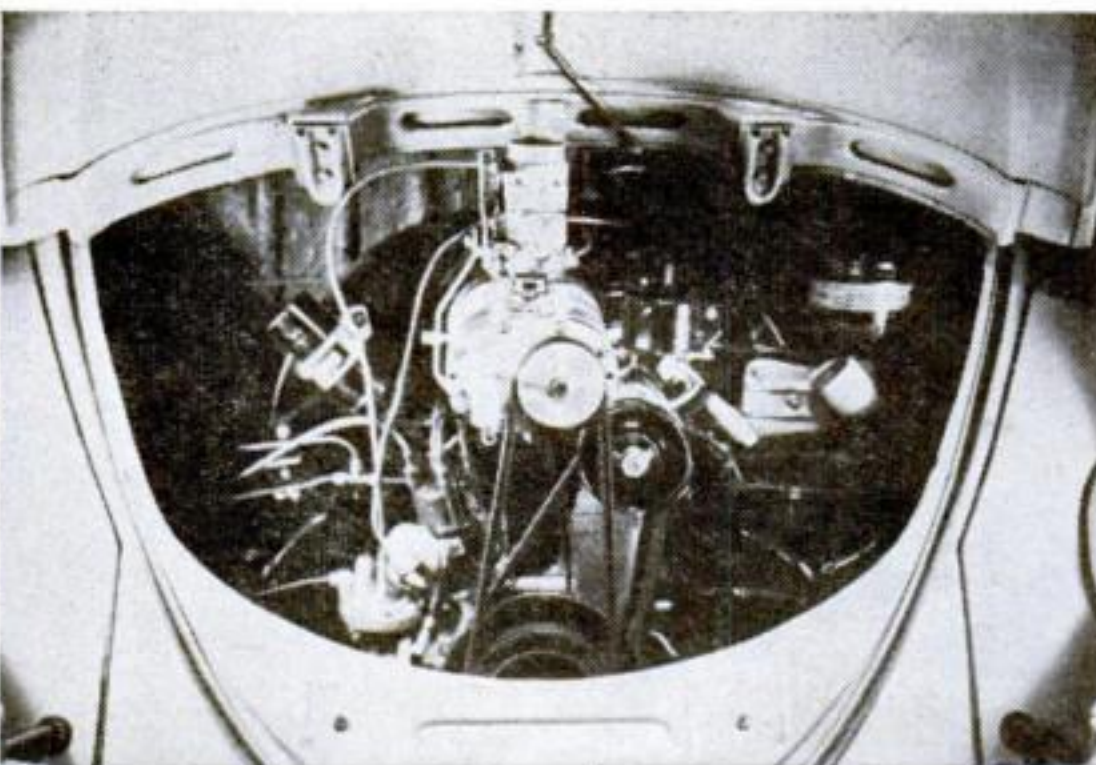
INTERCHANGEABLE TIPS make Shure-Drive "floating-head" hammer [PS, Aug. '60, p. 106] a five-in-one tool with separate plastic tip for delicate to heavy work. Floating striker in head adds inertia to impact, reduces rebound. Holder is \$10.50; tips, \$1.25 to \$1.75. Ramset Fastening System, New Haven, Conn.



SNORKEL SPRAY TUBE reaches inside car door or rocker panel to coat interior and stop rust. You punch hole, assemble tube on spray head, insert, and press. Kit contains 16-ounce can, punch, spray heads, plastic tubes, and steel buttons to plug holes. \$3.49. Rust-Oleum Corp., 2799 Oakton St., Evanston, Ill.



NYLON CLAMPS, with tension put on jaws by rubber bands, exert sufficient pressure for you to glue up models or hold small parts in place for soldering. Jaw face platens extend clamping area. Miniclamps come in five jaw sizes: $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, and $1\frac{1}{2}$ inches. Card of three smallest, with platens, \$1; two larger, with platens, \$1.29. Portable Structures, Inc., 8 E. 27 St., Minneapolis.



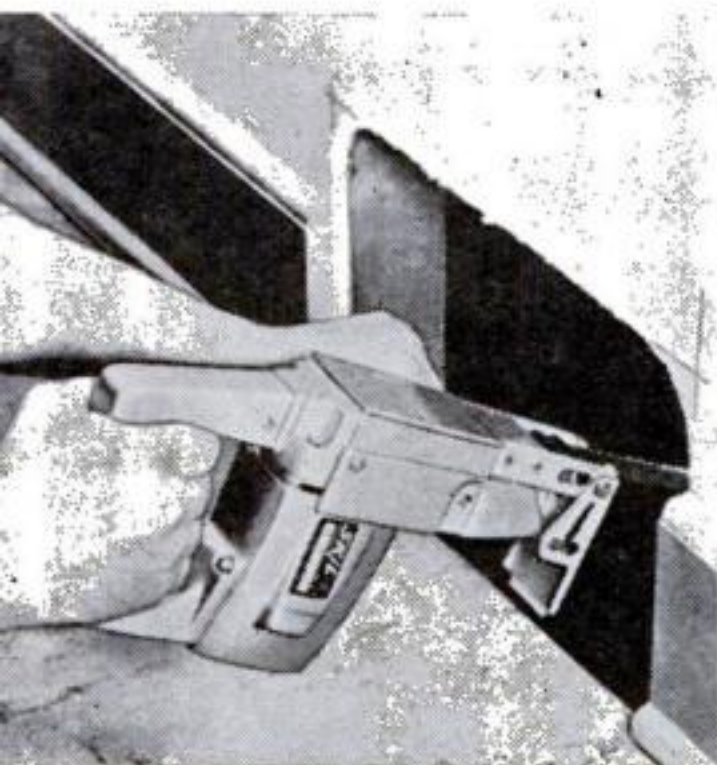
VOLKSWAGEN SUPERCHARGER is a blower fitted under the carburetor to step up air pressure five to eight pounds and give you, it's claimed, 30 to 50 percent more horsepower and 40 percent greater acceleration. Machined from aluminum-alloy casting, it has three lobes, two rotors, installs without removing engine. \$189.50. Crofton Co., Eighth and Harbor Dr., San Diego, Calif.



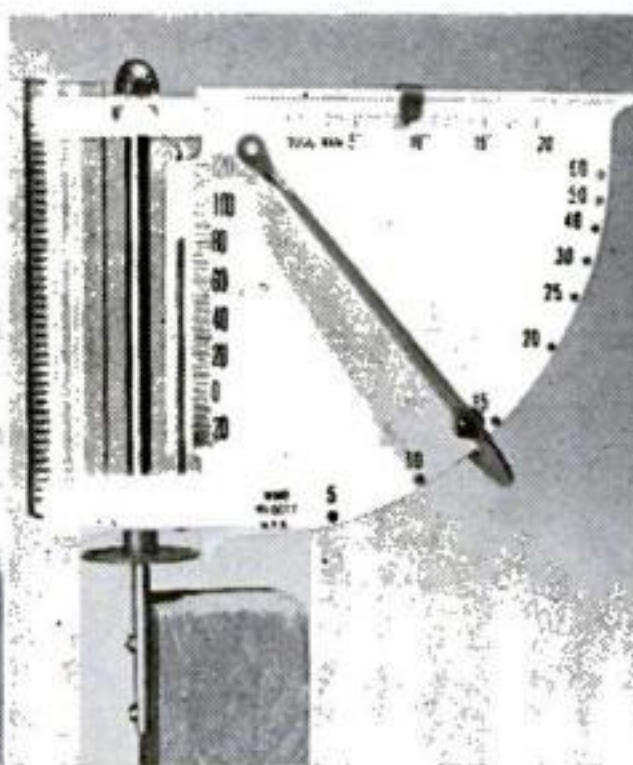
Guillotine cuts through bricks, stones, and tiles

With a blow of a two- or three-pound hammer on the sliding jaw of this portable cutter, you can get a clean fracture at any point on a brick, stone, or tile for precision fitting at ends or corners of a foundation or wall. It cuts at any

angle that brick or stone is placed between its blades. The Guillotine is lightweight but ruggedly constructed, with blades of steel hardened for a permanent cutting edge, \$12.95. Grant Mfg., 906 Bay Oaks Rd., Houston, Tex.



ALL-PURPOSE SAW makes flush cuts in corners; goes through six-inch posts; miters, bevels, and crosscuts any material. You can use Recipro Saw for roughing-in cuts or scrollwork, even in corrugated iron. \$49.95. Skil Corp., 5033 Elston Ave., Chicago.

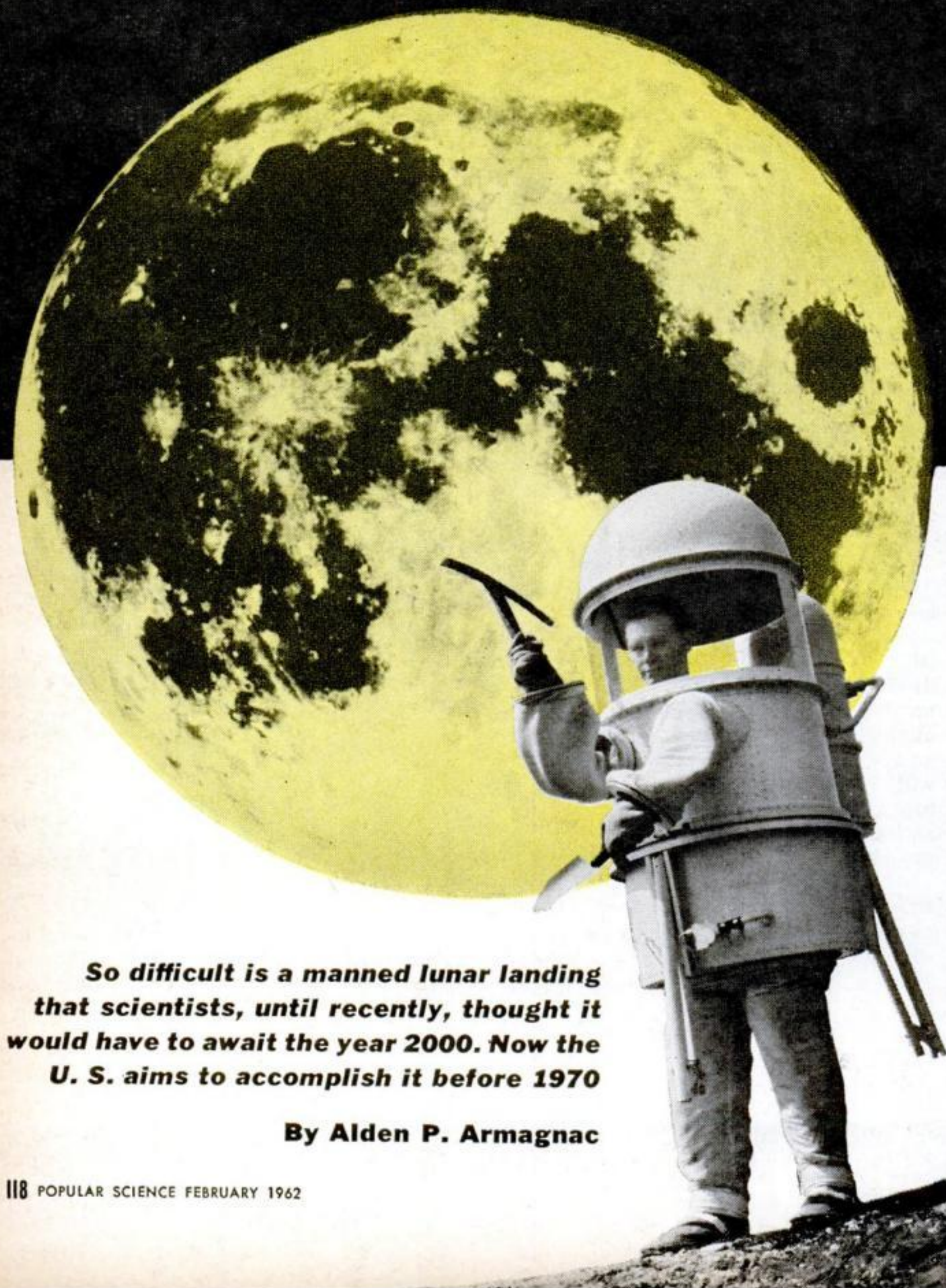


WEATHER GAUGE measures temperature, wind direction and velocity, and a day's rain in a calibrated tube. (By emptying tube and moving a pointer, you can record rain total.) Weatherama, \$2. Wm. Schwarts Associates, Box 547, Sheboygan, Wis.



CLIPPING CUTTER pushes pointed end of blade through magazine or newspaper page to let you remove article without damaging column next to it. Put cover back on, and you can carry it in pocket. 98 cents; extra head, 59 cents. Clipit, Janesville, Wis.

Ten Toughest Problems of Putting a Man on the Moon



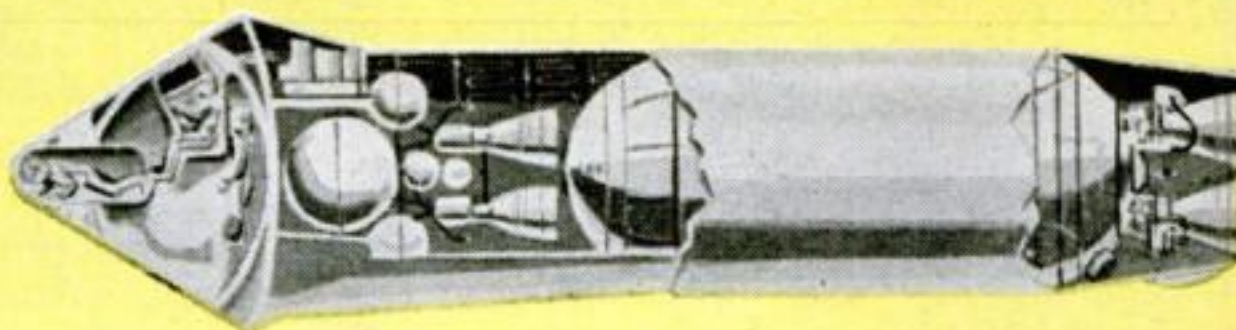
So difficult is a manned lunar landing that scientists, until recently, thought it would have to await the year 2000. Now the U. S. aims to accomplish it before 1970

By Alden P. Armagnac

A three-man expedition blasts off to the moon

FANTASTIC NOVA ROCKET, compared in size with newly tested Saturn, launches lunar-landing party from earth. Its 12-million-pound-thrust booster and two upper stages, firing successively, accelerate the manned lunar-landing craft at its nose to 25,000 m.p.h. — the “escape velocity” needed to overcome the pull of earth’s gravity and travel the 238,000 miles to the moon.

COMPARATIVE
SIZE OF
SATURN



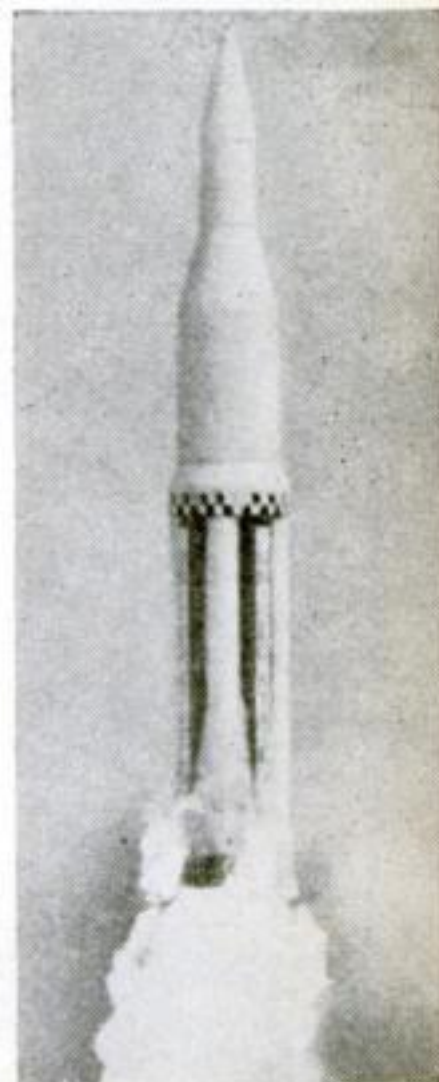
CREW OF THREE ride capsule at nose of lunar-landing craft, about 50 feet long, shown in cutaway view. Rockets at after end serve to descend on moon; those amidships, to return to earth.

WE'RE OFF, in the international race to land a man on the moon. The U. S. has put itself in the big league of rocketry by successfully launching its new Saturn rocket's 1½-million-pound-thrust booster.

Saturn's first, or booster, stage nearly doubles the 800,000-pound thrust of the huge Soviet boosters that launched their cosmonauts Gagarin and Titov into orbit. It will make our 162-foot-high, multistage Saturn the world's mightiest known rocket—if the Russians have one as powerful, it's their secret. Yet Saturn is only a start. For it will take a far bigger rocket than Saturn, and a lot else, to fulfill the aim of Project Apollo—the National Aeronautics and Space Administration's \$20 billion crash program to put Americans on the moon before 1970.

As NASA plans the great adventure, three men in a capsule atop the giant rocket will blast off on a 2½-day journey to the moon. On landing, they will emerge in space suits—perhaps like the trial “moon suit” pictured opposite—for at least four hours' exploring. Then, having blazed a trail for larger and longer expeditions, they will reboard their craft for the 2½-day trip back to earth. They will be in continuous touch with earth by two-way radio.

Our race with Russia to do it first is for sky-high stakes: tremendous prestige, answers to the moon's mysteries, and an upper hand in control over possible military uses of the moon—for example, as a base for launching missiles at earth targets, or as a strategic “Panama Canal” to future



UP GOES SATURN in successful firing of 162-foot-high rocket's big booster. Dummy upper stages served for test.

CONTINUED

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The great adventure—a landing on the moon, and the return

OFFICIAL DRAWINGS show current NASA ideas of how a manned craft will reach and leave moon. To land, craft comes in tail-first and nearly horizontally—a departure from former concept of vertical descent that may simplify any problem of sideslipping. After checking speed with retrorockets, craft uses jets on bottom to cushion landing on skids. At take-off—also in near-horizontal style—the tail section with spent retrorockets is left behind. A small, single rocket stage suffices to launch manned capsule toward earth. Having jettisoned booster, capsule alone plunges into earth's atmosphere—and, after surviving terrific heat of re-entry at 25,000 m.p.h., is lowered to landing by a pair of parachutes.



and even more remote outposts in space.

But formidable hurdles stand in our way—problems of staggering complexity. Here are the 10 biggest ones facing Project Apollo's planners:

1. The lunar landing craft. First comes the problem of designing the craft that will actually land on the moon—since all else will be built around it.

Even its size and shape are uncertain, at this writing. A preliminary NASA conception (see preceding page) shows only what it *may* look like:

Resembling a Fourth-of-July skyrocket minus the stick, the landing craft has nearly the length of a Redstone rocket, and the girth of an Atlas ICBM. A manned cabin forms its nose. This conical capsule, several times as large as that of the Mercury astronauts, enables the three-man crew to work in "shirt-

sleeves" surroundings—without space suits. It will provide food, water, oxygen, livable temperature and humidity. Retrorockets at the craft's tail will slow it to land on the moon; and rockets amidships will relaunch the capsule to return, alone, to earth.

Final design hinges on answers, still unknown, to questions as basic as this: Will the crew suffer ill effects, serious enough to imperil their mission, from prolonged weightlessness in space? If so, artificial gravity must be provided by rotating the craft in flight—which will complicate its design.

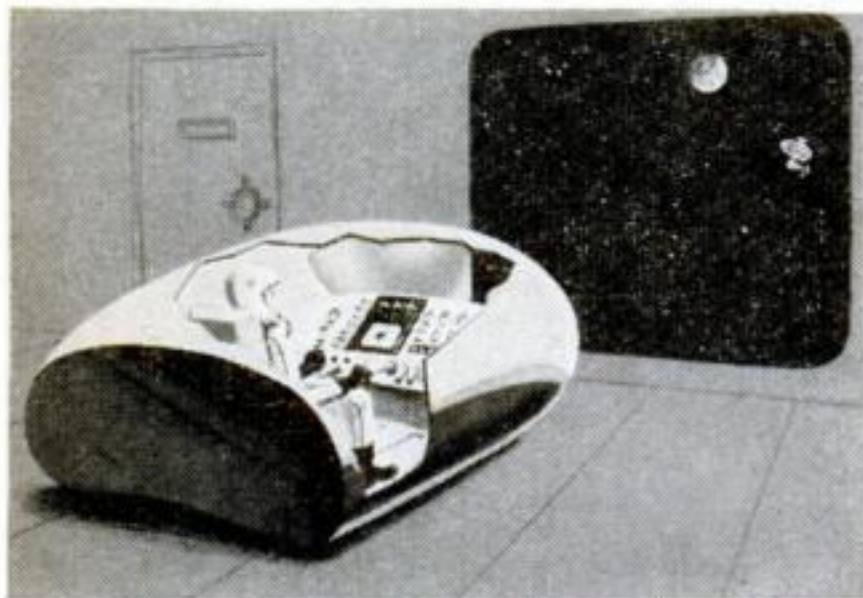
Currently this craft is expected to weigh 50 to 75 tons. Remember this is just the *payload*—which must be sped on its way by a far bigger launching rocket—and you begin to appreciate the problems of putting men on the moon.

2. Nonstop or rendezvous? Hotly debated at the moment are two rival proposals for the flight plan itself:

The brute-force approach—a nonstop flight from earth to moon—will take a launching rocket of colossal size. This has been the tentative plan. The rocket, the Nova, is being developed.

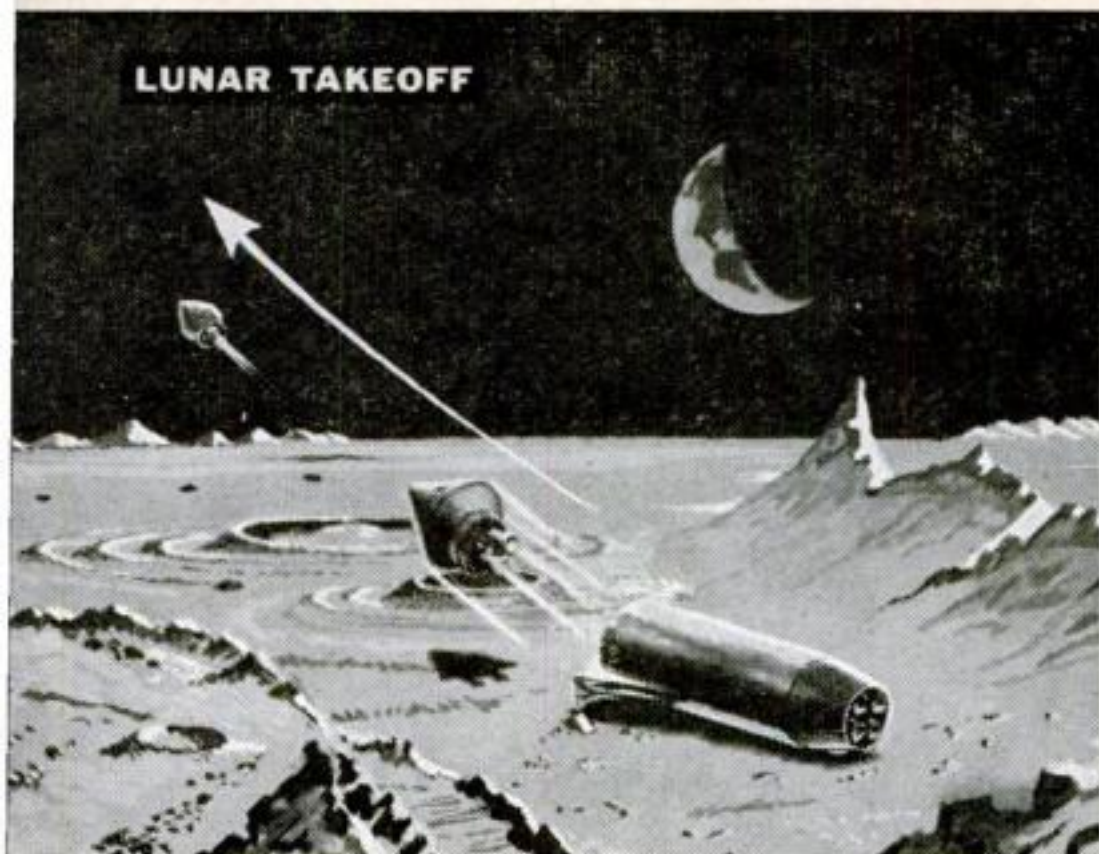
Lately gaining favor, however, is another plan as bold—the rendezvous concept. It would boost the launching rocket, in separate sections, into orbit around the earth—and join them there. Then the assembled rocket would head for the moon. It would dwarf our present Saturn, but need not be as huge as Nova.

Bringing together two vehicles in orbit, as this would require, has never been

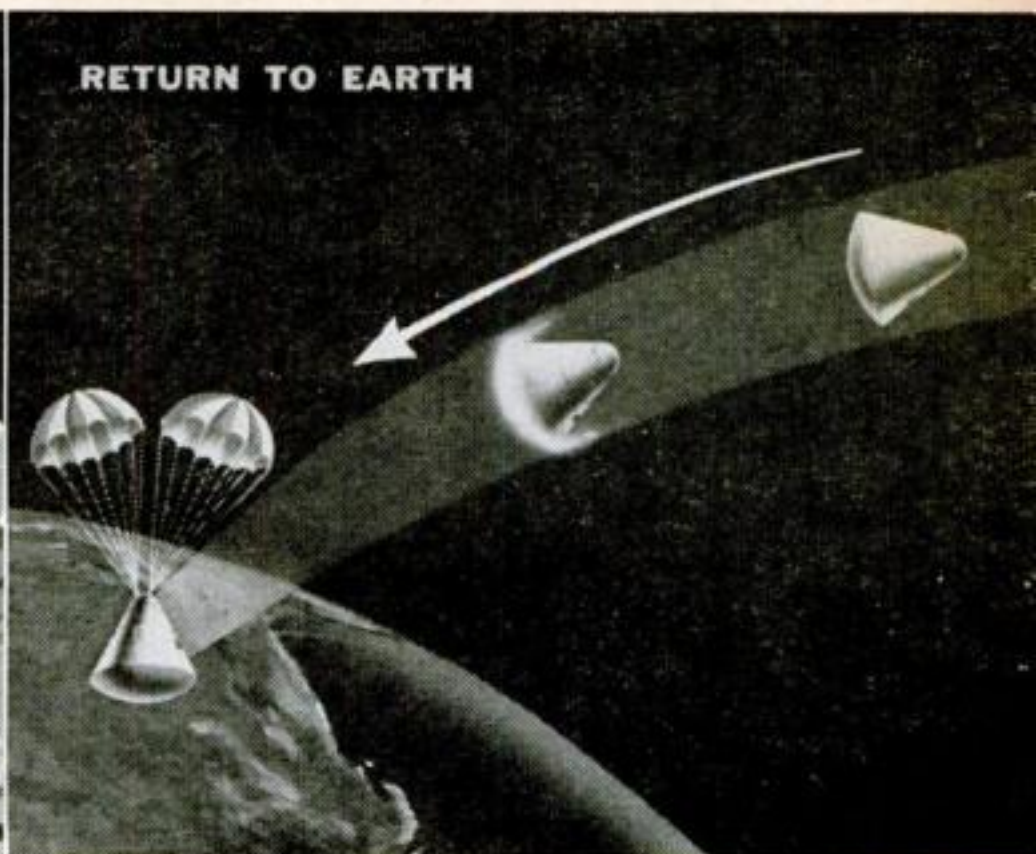


RENDEZVOUS MANEUVER for rival flight plan to moon is practiced with this trainer. Viewing space vehicle on screen, pilot works controls to bring his simulated rocket ship alongside.

LUNAR TAKEOFF



RETURN TO EARTH



tried. First attempts are due this year.

3. The launching rocket. With Nova we could put a locomotive on the moon, if we wanted to. The three-stage colossus will stand 360 feet tall. Its 50-foot-diameter booster will have eight rocket engines—each as powerful as all eight of Saturn's put together.

In the alternate rendezvous plan, two to four earth-launched rockets would assemble the moonship in orbit. Their

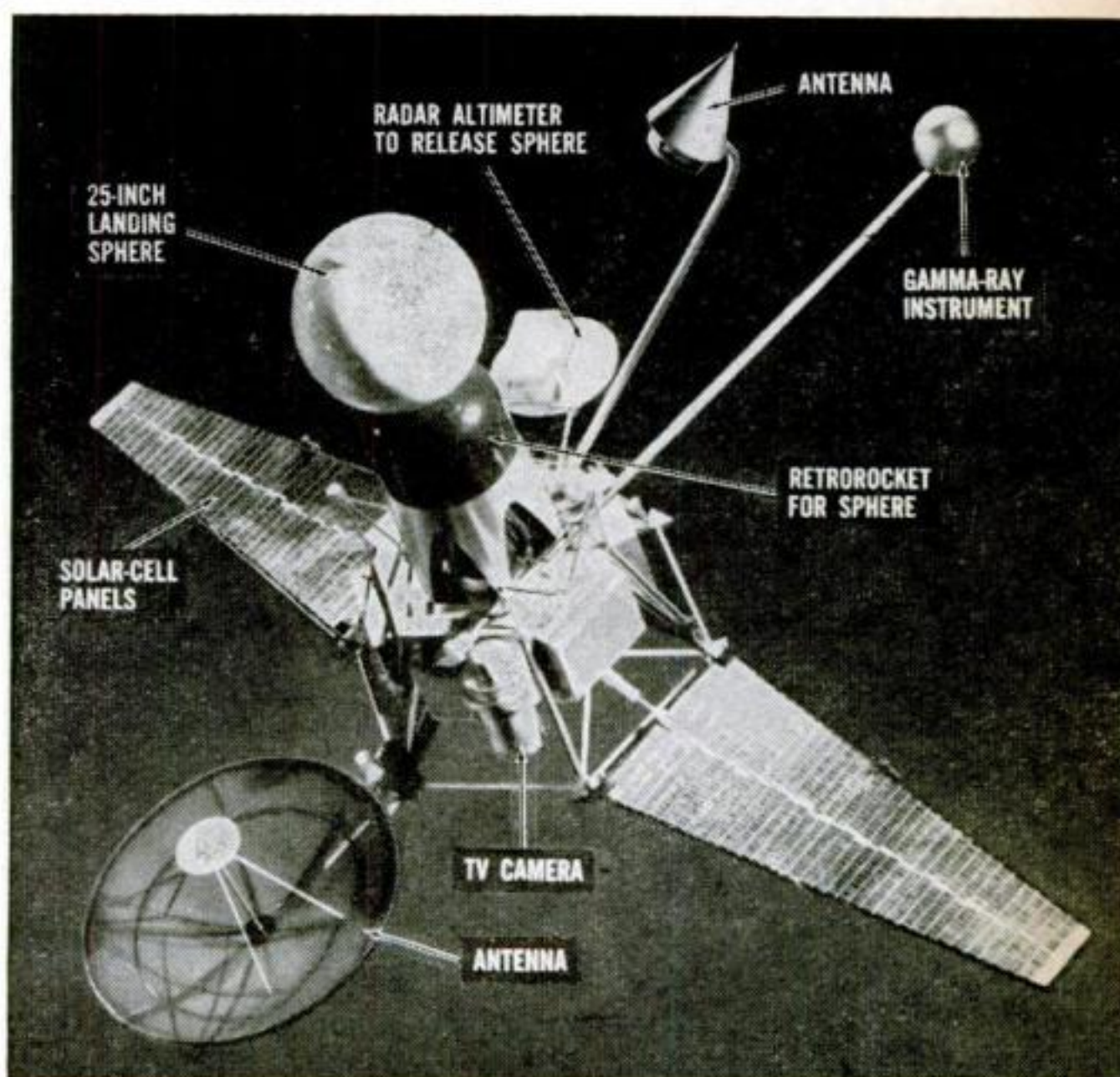
booster stages could consist of as few as two Nova-type rocket engines apiece.

Progress to date has been a successful ground-firing test of a Nova-type booster engine—the monster 1½-million-pound-thrust F-1, burning kerosene and oxygen. Simultaneously under development is a solid-fuel Nova engine of 2½ million pounds' thrust, five times as powerful as any solid-fuel rocket yet

[Continued on page 204]

Unmanned moonships to lead way

FIRST U.S. CRAFT to moon, due to get there this year, will be this crewless 17-foot-span Ranger. At 20-25 miles' altitude, it will drop landing sphere, to be slowed by retrorocket to "hard" lunar landing at less than 150 m.p.h. Protected within sphere's shock-absorbing shell of balsa wood, seismometer will detect moonquakes and radio will transmit data to earth. Craft itself, just before crashing, will send TV views of moon and gamma-ray readings of its radioactivity. After Ranger will come other unmanned craft to pioneer "soft" landings, and land cargo and beacons.



WE LIVE in an age of many names. The Space Age. The Atomic Age. The Age of Miracles. Yet more than anything else, it's the Electronic Age.

The Electronic Age belongs to everybody. Everything we do, in our homes, at work, or in our leisure, is touched in some way by the remarkable magic of electronics. More importantly, electronics is something we can touch and feel and see, play with and create with.

Electronics fills our homes with music and voices and pictures from far-off places. It will, if you choose, open and close your garage door, baby-sit a slumbering child, answer your telephone in the form of tape-recorded messages, detect fires and burglars,

turn your house lights on or off according to the position of the sun, and adjust your furnace to meet a coming cold snap long before your thermostat can sense the need.

You can buy electronic ovens that cook a meal in minutes. The electronic refrigerator, no longer one big box, will breed a whole new family of small, portable cold-makers: Your Martini chiller will plug in at the table, just like your electric coffee maker.

Future appliances may not even plug in. They'll be powered by thermoelectric devices that convert heat directly into electricity.

Some of today's wall-type gas furnaces already supply enough power to operate the thermostat and will soon run the blower as well. Eventually, electricity generated solely by thermocouples or

solar cells will run your entire home; the meter reader will be as obsolete as the iceman.

An electronic switch now dims headlights on some cars. The electronic "spark pump" may soon eliminate batteries, generators, and magnetos on auto engines, power mowers, and other gas-driven machinery. Your garage mechanic is now a man with a white collar and an oscilloscope. Already under way are electronic autopilots and anticollision radar to lower our tragic highway toll.

Those fantastic little transistors and printed circuits have miniaturized radios and hi-fi equipment to the point where you can put an entire sound studio on a bookshelf. Tube-changing is gone, servicing almost nonexistent. The Dick Tracy wrist-watch radio we dreamed about as kids is here; the wrist telephone is around the corner.

Television, which held us spellbound in its early days with fuzzy images of lady wrestlers, is about to cast its spell again. Tiny 13-pound portables the size of a bowling ball now run on either batteries or house current, enabling you to watch your favorite programs in a car, aboard a boat, on a camping trip, or at home.

Worldwide TV, now in planning, will transport us to far-away places that are merely exotic names on a map to most of us.

The Wonderful World of Electronics

Orbiting satellites, already used to record high-altitude weather patterns, will soon bring us breathtaking spectacles of outer space: close-ups of the moon's dark side, of Venus's still-unseen face, of the sun's magnificently fiery corona exploding against a black and airless sky.

All this will come to us in the comfort of our earthbound easy chairs. At the same time, TV will guide our missiles and spy on our enemies, keep an eye on the baby, and tell us who's knocking at the front door.

The marvels of electronics may at times seem frighteningly complex. They needn't be. Each is the logical result of adding one simple part to another simple part. Each, whether a giant computer or a one-tube radio, is made up of about a dozen basic electronic building blocks.

The fluorescent light we've taken for granted for years is a fearfully complicated device—but who looks at it that way? Schoolboys routinely build radio-controlled model boats and planes that would have staggered Edison. The phenomenal success of do-it-yourself kits has proved that many persons who have trouble changing a light bulb can faultlessly assemble an unimaginably intricate stereo amplifier or oscilloscope in their spare time.

This is the real wonder of the Electronic Age—the fact that you can personally participate in the latest advances, actually build and use the things that science invents—almost as fast as they're invented. Radar, born of a desperate war-time need, now helps the family boatman navigate a safe course in uncertain waters; sonar spots fish for the Sunday angler.

You can now buy these—and a hundred other intriguing gadgets—in inexpensive kits. Want to build an electronic organ, a computer? They're available, too. Kits have brought the world of electronics to the kitchen table.

Remember when they said you'd never operate your own radio transmitter without a ham license? Now you can set up your own broadcasting station in the form of simple two-way Citizens Band transceivers with no more trouble than enrolling in a book club. You can phone your wife from your boat that you'll be late for supper, or send out a call for help if your car breaks down.

Soon, computers will take over your wife's housework, telling each appliance exactly what to do and when to do it. Already close at hand are ultrasonic dishwashers and clothes washers, electronic air conditioning that will produce either warmth or coolth as you need it, electroluminescent lighting panels for bulbless illumination. Soon you may wear electronically heated and cooled clothing . . . Soon? It's almost here.—*Sheldon M. Gallager.*

On the next 26 pages,
Popular Science presents
this month's 90th-anniversary
bonus: a fact-packed section
on some of today's
electronic wonders

Big boom in electronic kits: Suddenly

Each month the catalogues fatten

By C. P. Gilmore



KIT MAKING IS BIG BUSINESS: This production line is just to pack parts in Heath's Benton Harbor, Mich., plant. Packaged kits, awaiting shipment, tower along background wall.

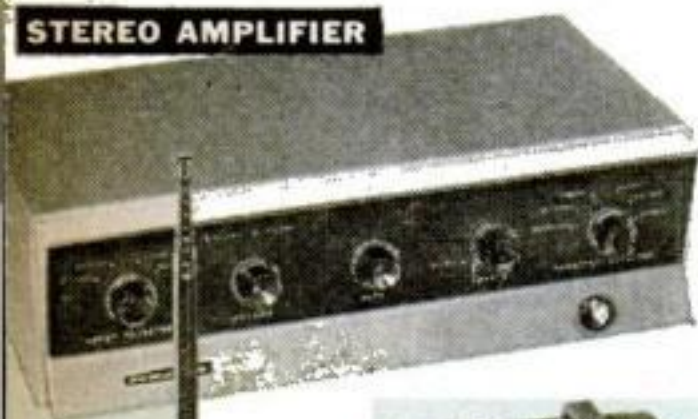
MEN build hi-fi kits to listen to music and records of sports-car races. Women build clock-radio kits, turn them on while they do the housework. Kids build educational kits and learn about electronics.

In fact, just about everybody builds kits these days. One leading kit maker analyzed his returned guarantee cards and found more than 400 professions represented, from acrobats to zoologists.

The kits are big business. In 1960, fans across the U. S. bought \$75 million worth of resistors, condensers, and other such hardware which they converted into TV sets, Citizens Band

Roundup of one company's kits shows the wide range available

STEREO AMPLIFIER



OSCILLOSCOPE



KIE-TALKIE



HOME INTERCOM



RECORD CHANGER

TRANSCEIVER



COMPLETE STEREO CONSOLE

Everybody's Soldering

as the U.S. turns itself into a coast-to-coast assembly line

transceivers, oscilloscopes, and hundreds of other electronic instruments. Last year, although the totals aren't in yet, it's certain they bought even more.

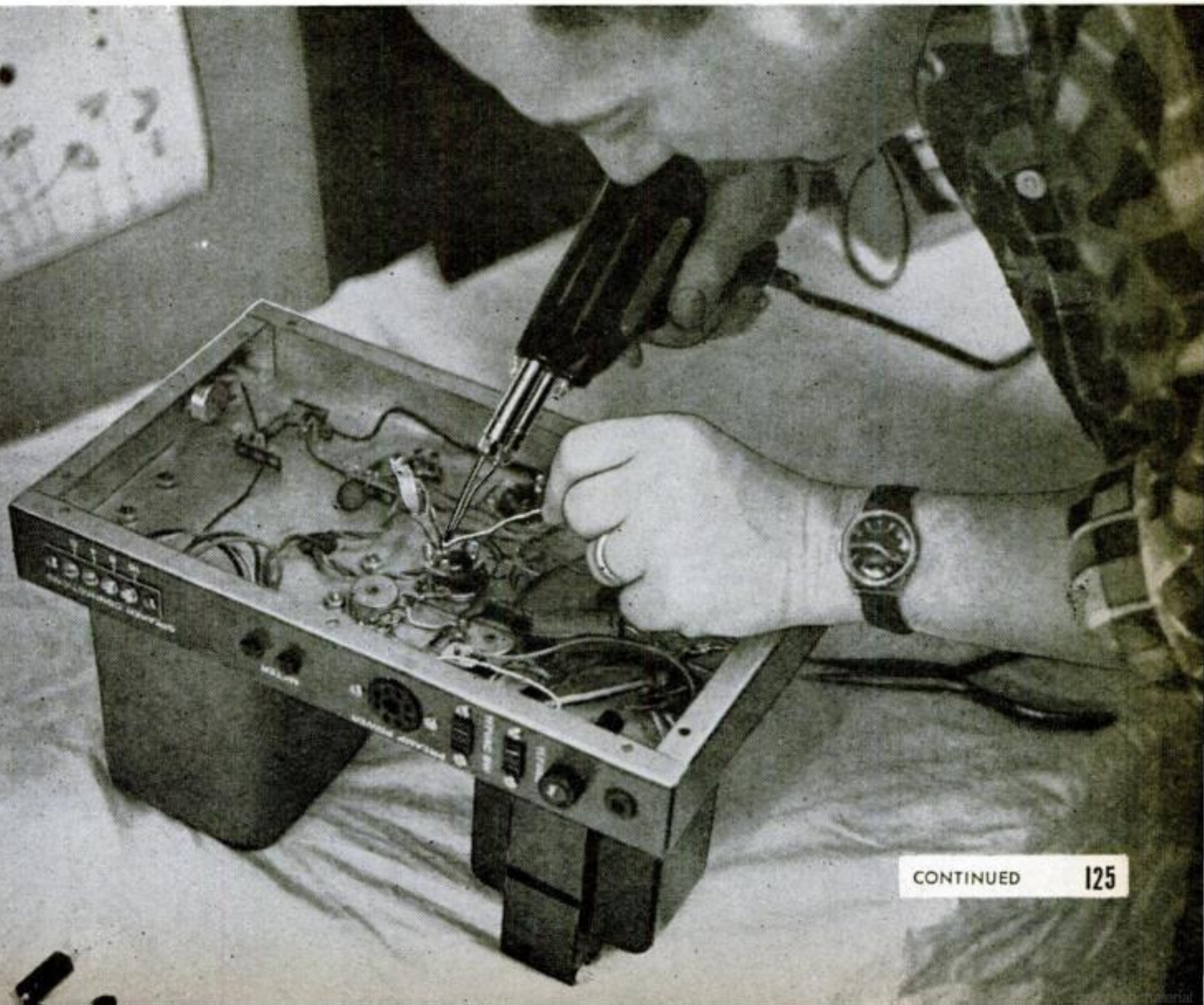
One reason we build so many kits: Kit builders tend to become addicts. One success leads to another. A surgeon in Benton Harbor, Mich., builds hi-fi kits for relaxation after a tough day with a scalpel.

Captain I. L. Risseuw, who chauffeurs a KLM airliner across the Atlantic, uses kits for the same purpose but goes about it in a different way. A few months ago the flying Dutchman dropped into the Schober Organ headquarters in New York, tried playing a demonstration model, and decided to

build one. He bought a subassembly kit and built it in his hotel room during his layover in New York. Now, whenever he has a few days between flights, he buys another subassembly, builds it in New York, then takes it back to Holland with him. There, the completed units are slowly being fashioned into a full-size electronic organ.

Pleasure and profit. Most kits are built for pleasure, although some kit builders—TV servicemen, for example, who use the completed instruments in their business—build for profit. But the all-time champion money-making kit builder is not a TV repairman. He's a bond dealer named William S. Morris. Morris founded a small firm in New York about two

Wiring a hi-fi amplifier isn't tricky if you follow diagrams that come with this EICO kit.



CONTINUED

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PROFIT-MAKING CHAMP of do-it-yourself kits is this computer that bond dealer William Morris built. It let him underbid Bank of America for a bond issue, earning him nearly \$2 million.

years ago to buy and sell bonds. To simplify the complicated business of figuring interest rates on bond issues, he bought a computer kit for \$945 from the Heath Company of Benton Harbor, Mich., built it himself, and installed it in his office.

Last August the State of California decided to issue \$100 million worth of bonds. Financiers across the country took it for granted that a multi-billion-dollar syndicate headed by the powerful Bank of America would submit the winning bid. After all, the syndicate had won every California issue for years. Nobody else had even bid against this financial colossus since 1956.

Morris had other ideas. He retired to his office, fed reams of facts and figures to his computer, and arrived at a bid. When the bids were opened, the red-faced Bank of America syndicate was out and Morris was in. Within 48 hours he had resold the bonds. His return for two days of work: a cool million. But that's not all. A few weeks later he put his homemade thinking machine to work again and underbid the still-reeling California giant a second time. This time, though, he cleared only \$800,000.

Most people, of course, don't build kits to make money. Sociologists tell us

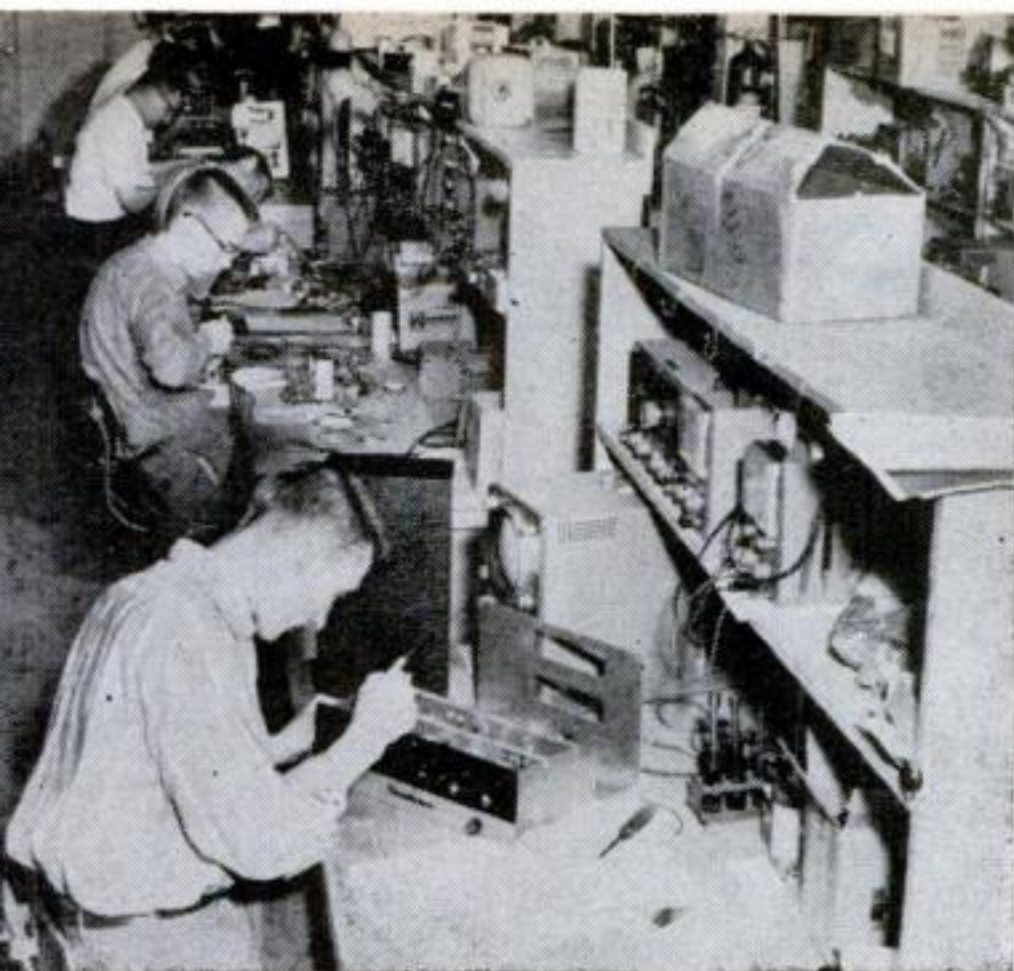


KIT IDEA ISN'T NEW: This 1929 Allied Radio catalogue offered many nonassembled sets. Note that short-wave built from kit "may be used for television"—then only a dim prospect.

that with our highly mechanized society, and with spare time on our hands, we're likely to get the urge to do something creative. Given that urge, kits make sense. You get a lot more equipment for a given number of dollars than you would buying a ready-made unit. And people like to astound their friends and impress their wives (or husbands). Finally, they get a chance to learn a little about the fascinating world of electronics.

Anyone can do it. Kit building requires no special talent, except perhaps patience and the ability to follow directions. Most manufacturers guarantee that you will be able to complete the kit you start or you get your money back. Today's kit instruction books are masterpieces of clarity and detail. Even if you can't tell a capacitor from a can opener, you need have no fear of approaching a kit.

Manufacturers see to this by having a number of rank amateurs—secretaries, salesmen, and others with absolutely no electronic knowledge or kit-building experience—build every kit before it is put on sale. If they consistently make mistakes, the designers figure something's not clear about the instructions, change them until volunteers are turning out perfect instruments.



IF YOU GOOF? Even following explicit directions, a few buyers do. All is not lost. Ship it back to the factory for these technicians to put right. You're still many dollars ahead.

Even with such precautions it's still *possible* to go wrong while building a kit. But it doesn't have to be a tragedy. Let's say you've just finished the last lovely soldered connection on the Triple-X-100 stereo amplifier you've been working on evenings for a week.

Now comes the big moment. With swelling chest you plug it in and turn on the switch. The gleaming red eye on the front panel winks cheerfully. Trying your best to be casual, you nonchalantly put on a phonograph record and turn up the volume.

Nothing happens. Slightly shaken but still fairly confident, you fiddle with the



COMPACT KIT: You needn't spread out all over the place with this one. The Scott amplifier is made without taking it from workbench carton. Instruction book props up inside lid.

controls, tap the panel gently, kick the table. Still nothing. Should you get panicky? No. There's help nearby. Open the instruction manual and turn to the "What to Do in Case of Trouble" section. Follow the directions and you'll probably clear up the difficulty in a few minutes.

Even if that doesn't work, don't give up. As calmly as possible, sit down and write the manufacturer, telling all. His trouble-shooting department will be able to tell from your letter—if you give enough details—exactly what is wrong. If this fails, there is still one sure remedy. Pack up your unit and send it back to the factory. There, for a small fee, fac-

It All Began with a Monoplane Kit

As early as 1927, the Heath Airplane Company, forerunner of today's electronic-kit maker, offered a do-it-yourself airplane, the Parasol. The kit sold for \$199. But if you wanted to test your construction skill (in flight), the engine was \$300 extra.





INSTRUCTIONAL KITS DIFFER from others in that the means—not the ends—are stressed. This kit addict learns use of his Heath voltmeter by creating a power supply for experiments.



KITS YOU NEVER FINISH teach and entertain. With this electronics lab from Allied Radio, you can build a hundred different circuits—from lie detector to radio broadcaster.

tory technicians will put it in first-class working order.

What are the chances of trouble? Records at Heath show that the company never hears from 98 percent of its customers—that is, until they order their next kit. Of the remaining two percent, most have minor difficulties that are taken care of by mail. Finally, a tiny percentage end up shipping their units back to the factory.

Your chances of staying out of trouble are particularly good if you're a beginner. The head of one factory service department told me that much of the trouble comes from kits built by technicians and TV servicemen. The reason: Since they know something about the circuits they're building, they frequently ignore directions, modify circuits and layouts.

What causes most of the trouble among those who follow directions? Factory technicians agree on one overwhelming source, accounting for at least 7 out of every 10 units returned for servicing: the cold solder joint. This is a soldered connection that wasn't heated enough, so the solder doesn't stick properly. A technician simply goes through the unit, reheating all the connections.

Next most common trouble: wiring mistakes. If your unit doesn't work after you're sure you have no cold solder joints, check through the entire circuit for wiring errors. If you can't find any, have a friend check through it again. Maybe a fresh eye will see something you missed. One more possibility: Check to see if a little blob of solder has run down a terminal somewhere and shorted out a connection. A small piece of stray wire can do the same thing.

If all else fails. If you can't find any of these defects, the villain may be a defective part. Kit manufacturers go to great lengths to weed out bad components, but once in a while one will get through. Without test equipment, you won't be able to do much except send it back to the factory. Defective parts are replaced free.

Occasionally a kit manufacturer's technical-correspondence department gets a specially urgent problem. One builder wrote that he was having trouble with a grid-dip meter he had just built. Furthermore, his wife had just delivered an ultimatum: "Get that junk off of my dining-room table or I personally will throw it all in the garbage can." A letter of advice saved the kit—and possibly even the marriage.

Although the kit business has been enjoying a spectacular boom in the last decade, it actually got started back as early as the 1920s. By 1929 the catalogue of Allied Radio of Chicago, one of today's big kit makers, showed a full line

[Continued on page 226]



COLOR TV

Is It Worth the Money?

An expert on TV color circuits confesses he got quite a surprise when he finally broke down and bought a color-TV set

By Charles Tepfer

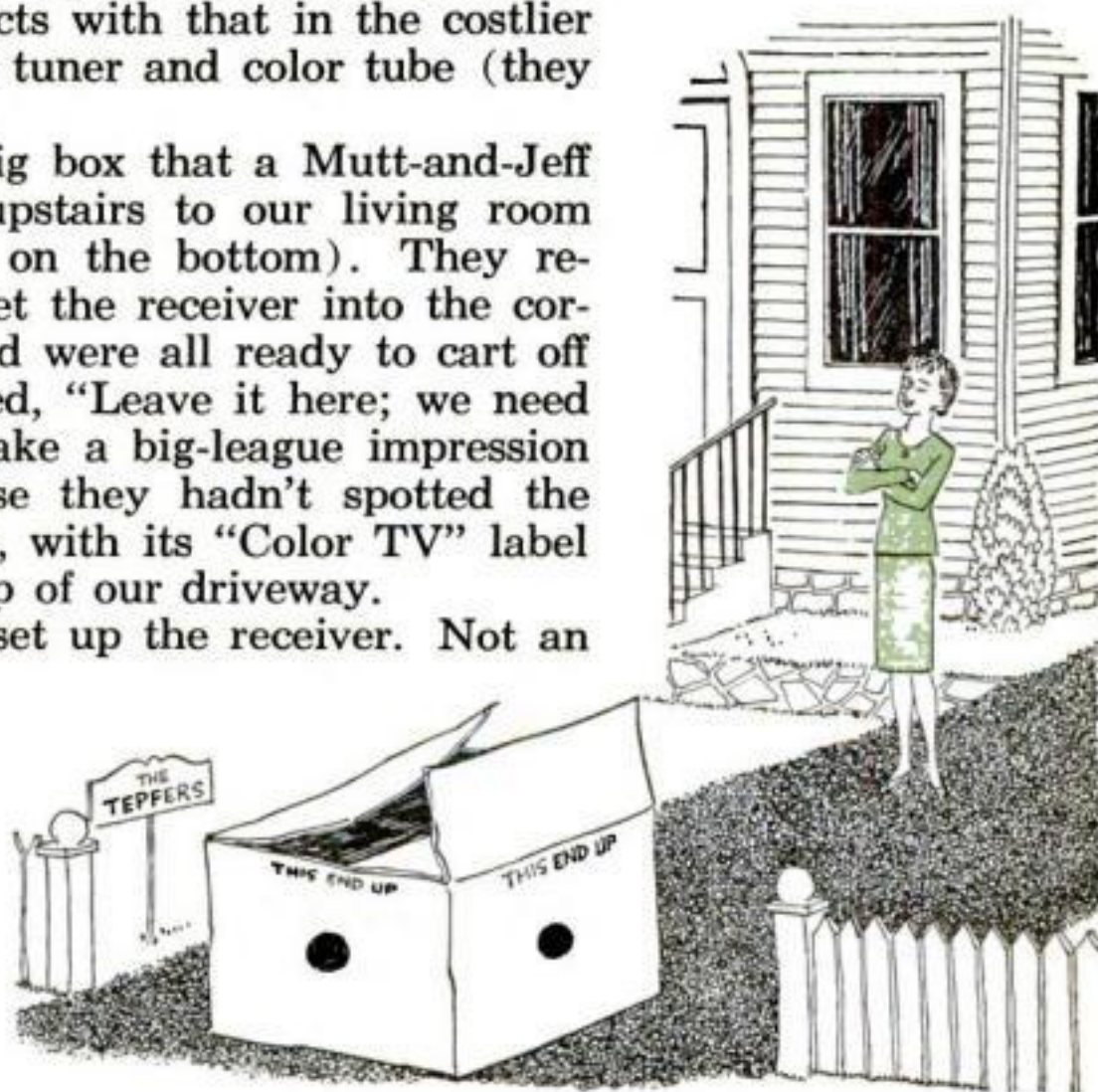
WHEN I had a chance to examine the new color-TV circuits recently, I realized how far color TV had come along. For too long, I decided, I had been like the cobbler with no shoes of his own. I made up my mind to buy a color-TV set.

We picked out a \$500 RCA set because its chassis is identical in all important aspects with that in the costlier sets. It has the same Nuvistor tuner and color tube (they are all 21" in diameter).

The color set arrived in a big box that a Mutt-and-Jeff team of deliverymen hauled upstairs to our living room (naturally, the little guy was on the bottom). They removed the set from the box, set the receiver into the corner we had prepared for it, and were all ready to cart off the box when my wife protested, "Leave it here; we need it!" This was her chance to make a big-league impression on our neighbors (just in case they hadn't spotted the truck). She set the empty box, with its "Color TV" label plainly in view, right at the top of our driveway.

Soon a serviceman came to set up the receiver. Not an extra-charge operation, installation is free for color-TV buyers. The serviceman explained to my wife what he was doing, but she fled to the kitchen the minute he started to wave his degaussing coil around the picture tube to demagnetize it. The last time she had seen anything like that was when I had built a Tesla coil and the transformer burned up. I guess she remembered. Still, when the serviceman left, after a setup time of three-quarters of an hour, she was all wrapped up in "It Could Be You" in full color.

One thing that made the job so fast was that the service-



She set the empty box, with its label in plain view, at the top of our driveway.

man didn't have to strap a new antenna to my chimney. He decided that our picture was excellent when connected to the antenna we had. This came as a surprise to me because my antenna merely lies on the rafters in the attic.

We live about 35 airline miles from New York City. At the least, I thought, we would have to set it up outside.

Next came surprise Number 2: The color-TV set brought in a better picture on all channels than my black-and-white set, and brought in one channel I'd never gotten before.

The first color show on that evening was a quiz game, "Concentration." Ordinarily I would have switched to another channel. This time I watched the show clear through to the end: Color had made it bearable for me. Why? Well, watching any show in color was novel. But there was more to it than that. The scene seemed to be three-dimensional and, no question about it, the girls looked cuter.

Incidentally, I didn't have to change the color controls on the set at all during the show; I guess I agreed with the serviceman as to what was a true flesh tone. He had adjusted the set for this before he left.

The next show we watched was a color movie with Brigitte Bardot. The color was pleasant but not spectacular; it seemed rather washed out. I tried those controls marked "Tint" and "Color" to see if they could sparkle up the picture. The first controls the actual colors of the picture and can vary a face from sickly green to deep lavender; the other varies the amount of color in the picture, from oversaturated to none—that is, black and white. Adjusting these controls brought new life to the picture. Of course my wife suggested that the only reason I got so worked up about the color was because I really was trying to get Bardot in the flesh; she said I took this three-dimensional effect too seriously.

Since the set also has a tone control, I naturally fiddled with it. It isn't very effective except in cutting high frequencies—it gives more bass by simply cutting the highs.

Some other impressions:

1. The contrast control is not as effective on a color picture as it is on black and white.

2. On unoccupied channels you get multicolored confetti, one sure way of showing off your color-TV set when no color programs are on.

3. The black-and-white picture on the color tube is less sharp than on a black-and-white set; the color tube needs three light spots to make black (equal blue, green, and red) to the black-and-white set's one spot.

4. The color varies with the TV studio lighting and camera. Bright colors in the foreground muddy up in the background; some colors actually appear changed.

5. Color is truest on live shows, next best on taped shows, and varies from good to poor on filmed shows.



The patient serviceman tried to explain to my wife what he was doing—but she fled to the kitchen.



Watching any show in color was novel, but there was more to it than that—the scene seemed to be three-dimensional.

BUYER'S GUIDE TO COLOR TV SETS

Make	No. of Models	Price Range	Chassis Type	Picture Size ^a	High Voltage ^b	Tuner Type	Remote Control	No. of Speakers	Printed Circuits
Admiral	6	\$595-\$1,000	RCA	21" ^c	24,000	Nuvistor	on some	1 or more	yes
Delmonico-International	1	\$595	Victor of Japan	21"	24,000	Cascode	no	6	no
DuMont	3	\$795	RCA	21"	24,000	Nuvistor	no	3	yes
Emerson	2	\$750	RCA	21"	24,000	Nuvistor	no	2	yes
General Electric	8	\$529-\$700	RCA	21"	24,000	Nuvistor	no	1 or 2	yes
Magnavox	3	\$699-\$795	RCA	21"	24,000	Nuvistor	no	2 or 3	yes
Olympic	2	\$795-\$1,195	RCA	21"	24,000	Nuvistor	no	2 or more	yes
Packard-Bell	2	\$895-\$1,325	RCA	21"	24,000	Nuvistor	no	—	yes
Philco	5	\$750-\$900	RCA	21"	24,000	Nuvistor	no	1	yes
RCA	21	\$495-\$1,500	RCA	21" ^c	24,000	Nuvistor	on some	1 to 6	yes
Zenith	10	\$695-\$1,050	Zenith	21" ^c	24,000	Neutrode	on some	1 to 3	no

^aTotal diameter of round picture-tube faceplate. ^bWith normal three-beam current. ^cSome models have bonded-faceplate picture tube.

... And bear in mind

1. The Nuvistor is an RCA-developed, transistor-size metal-ceramic vacuum tube whose triode elements are so close together that the tube yields tremendous gain at a high signal-to-noise ratio. Its type number is 6CW4 (black-and-white portable sets use the 2CW4) and it is used as a low-noise (or snow) r.f. amplifier for greater sensitivity.

2. All RCA-type chassis include a back-of-the-set circuit breaker, eliminating the need for changing a fuse or calling a serviceman if it opens as a result of momentary overloads.

3. The high-voltage circuits in all color-TV sets are well regulated, must not vary

by more than one percent from 24,000 volts or the three beams won't converge.

4. All color sets have one-step fine tuning. This needs adjustment when the set is installed, but seldom afterwards.

5. A new TV antenna may be necessary if the old one is a narrow-band-width type.

6. All color picture tubes are presently made by RCA.

7. Most of the RCA-type chassis listed on the table are made by RCA.

8. Best buy in any brand is the least expensive table model or "console"; generally all models use the same chassis.

9. RCA offers free 90-day service (including parts and labor) plus a year's warranty on all parts including picture tube; most other manufacturers do, too.

6. Many color shows are unimpressive after the novelty has worn off. Many are not designed for color—one show had a big dance production with the dancers wearing black-and-white costumes.

7. But the sense of participation in color shows is heightened. This, I suppose, is due to the naturalness of seeing everything in its true colors. We become more absorbed in the stories; the dividing line between make-believe and the real thing is not so sharp.

Saturday is color day for the kids, with good cartoon and live shows. Of course, it wasn't long before the neighbors' kids were knocking on our door early Saturday and asking to come in and play, actually to watch. Our kids were never so popular. Another dividend we hadn't counted on—we no longer have any trouble at our house getting baby sitters.

About 40 percent of NBC's evening schedule is in color, plus most of the special shows. Many independent TV stations such as Channel 9 in New York City, WGN-TV

[Continued on page 221]



On unoccupied channels you get multicolored confetti—one sure way of showing off your color-TV set.

Solution to a living-room space problem:

Hi-Fi Stereo Bench

By David Gordon

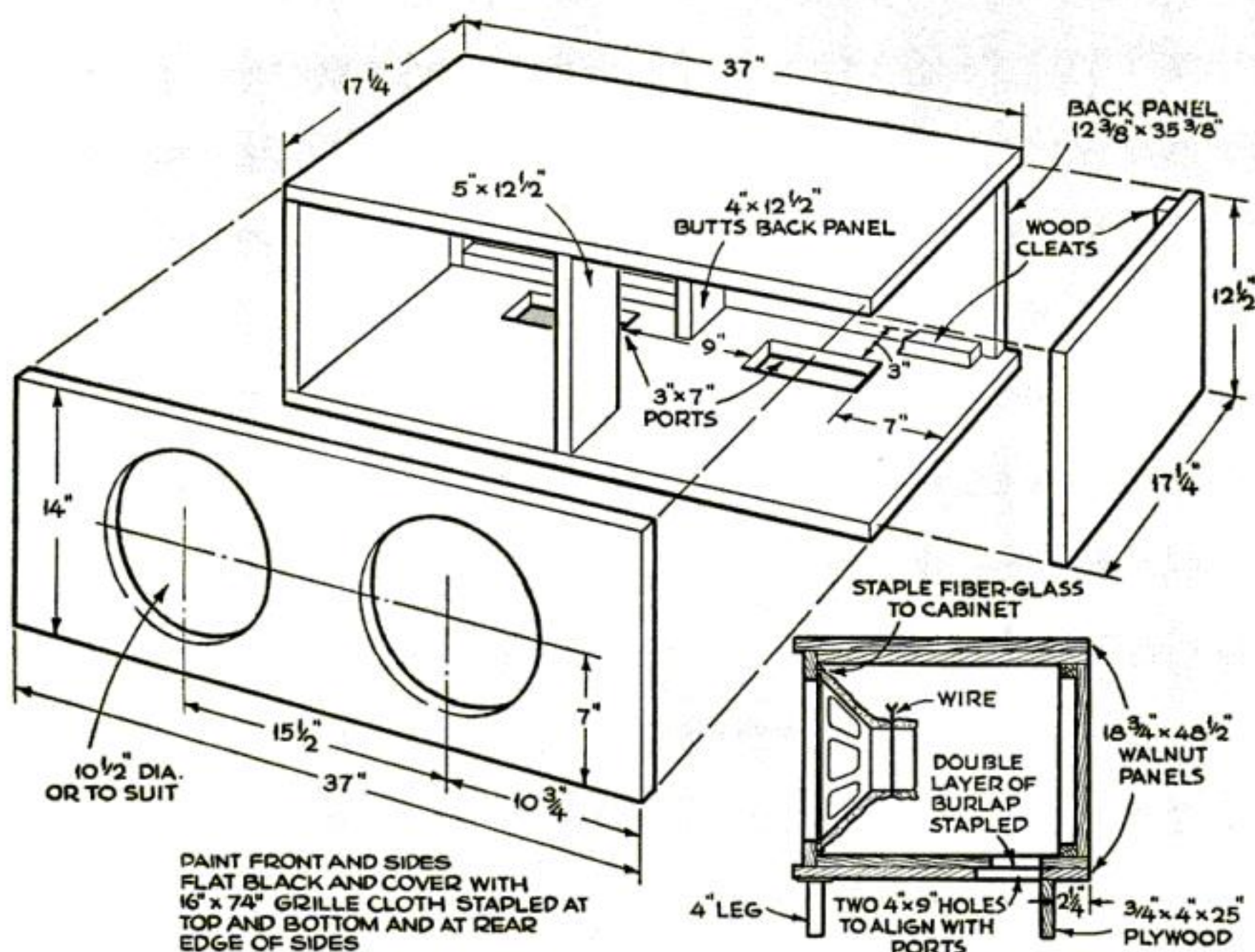
HERE'S an ingenious solution to the problem of bringing stereo sound into a small room—on a modest budget.

The experts say you need two identical speaker systems at least eight feet apart—which is fine if you have the space and the money. This home-built satellite speaker system solves both problems. You needn't wait for Aunt Martha's

legacy to enjoy good stereo in even the smallest living room.

One handsome piece of furniture is all you have to find room for. The usual drawback of a single-cabinet stereo speaker—insufficient separation between the two sound sources—is avoided by a system that takes advantage of the way our ears actually hear.

Research shows that it is mainly the

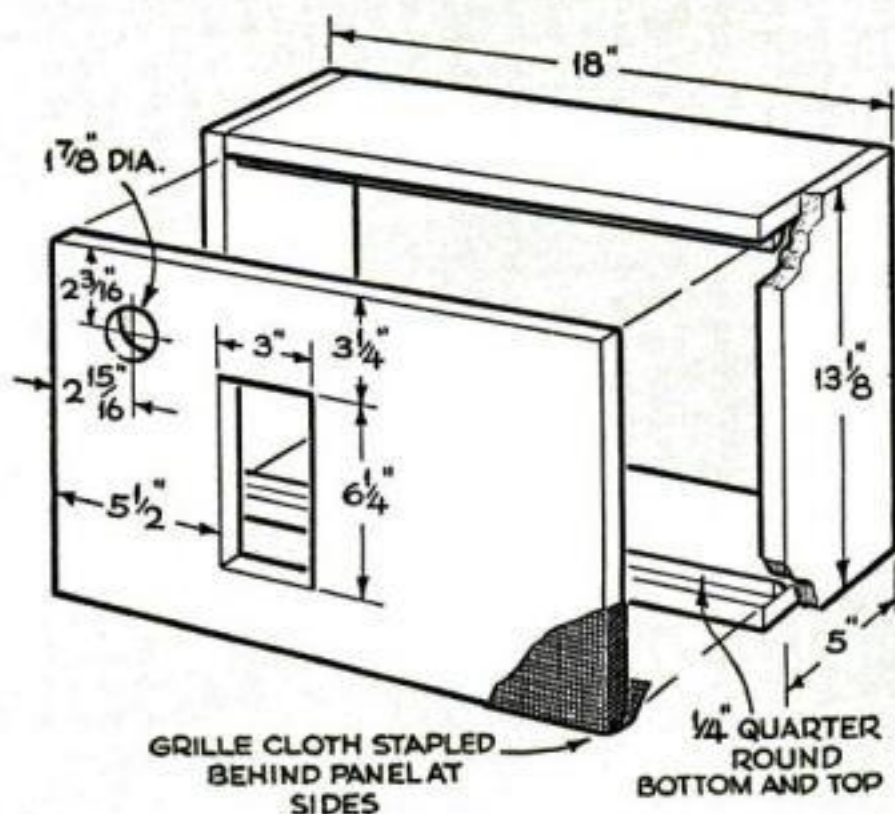


Mechanics and Handicraft SECTION



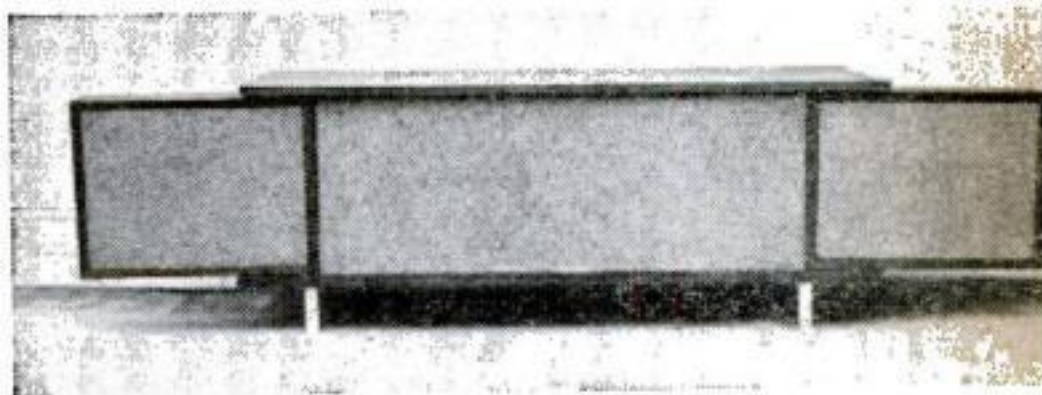
**The woofer
stays home
while the
satellites
roam**

*Leave end speakers at right angles
to woofer enclosure . . .*

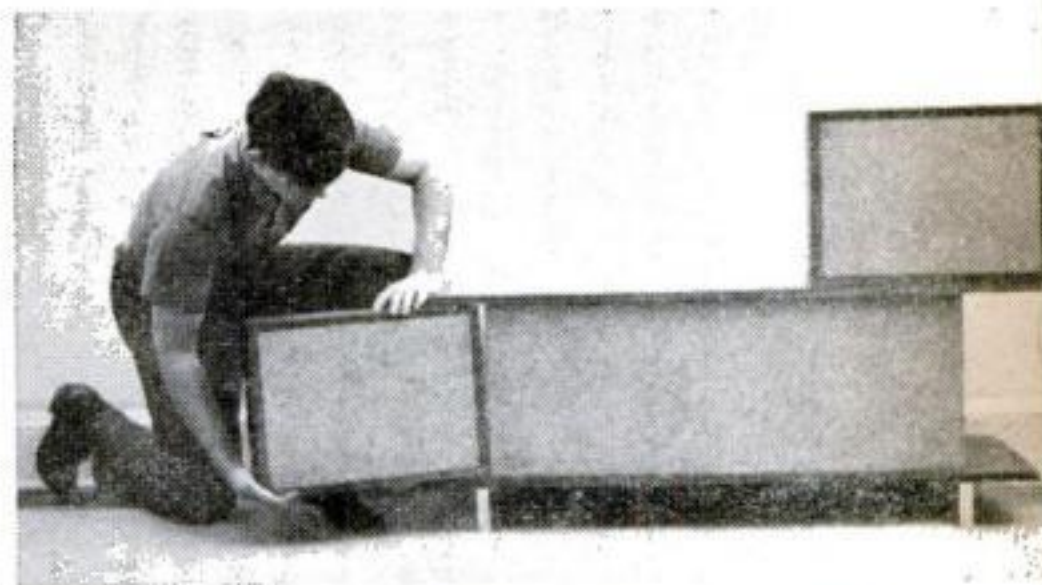


PARTS LIST

- | | |
|--|---|
| 2 12" woofers
(Olson S-347) | 2 chokes, 3.7 millihenries
(L1). Homemade by random-
winding 460 turns of #18
enameled wire on coil form |
| 2 8" midrange speakers
(Olson S-278) | 2 chokes, .25 millihenries
(L2). 150 turns #18
enameled wire, wound as
above |
| 2 2" tweeters
(Olson S-345) | (A total of 3 lb. of #18
enameled copper wire is
needed for above coils) |
| 2 level controls
(Olson VC-104) | 1 4' x 8' sheet 3/4"
Weldwood Novoply |
| 2 4 mfd. nonpolarized
capacitors | 2 walnut-faced (or personal
choice) plywood panels,
3/4" x 18 3/4" x 48 1/2" |
| 2 50 mfd. nonpolarized
capacitors | |
| (Above parts were purchased
from Olson Radio, 260 S.
Forge St., Akron 8, Ohio) | |
| Misc.: Lumber for cleats and satellites, 4" legs, grille cloth,
hardboard and dowel for coil forms. | |



Swing them to the front . . .



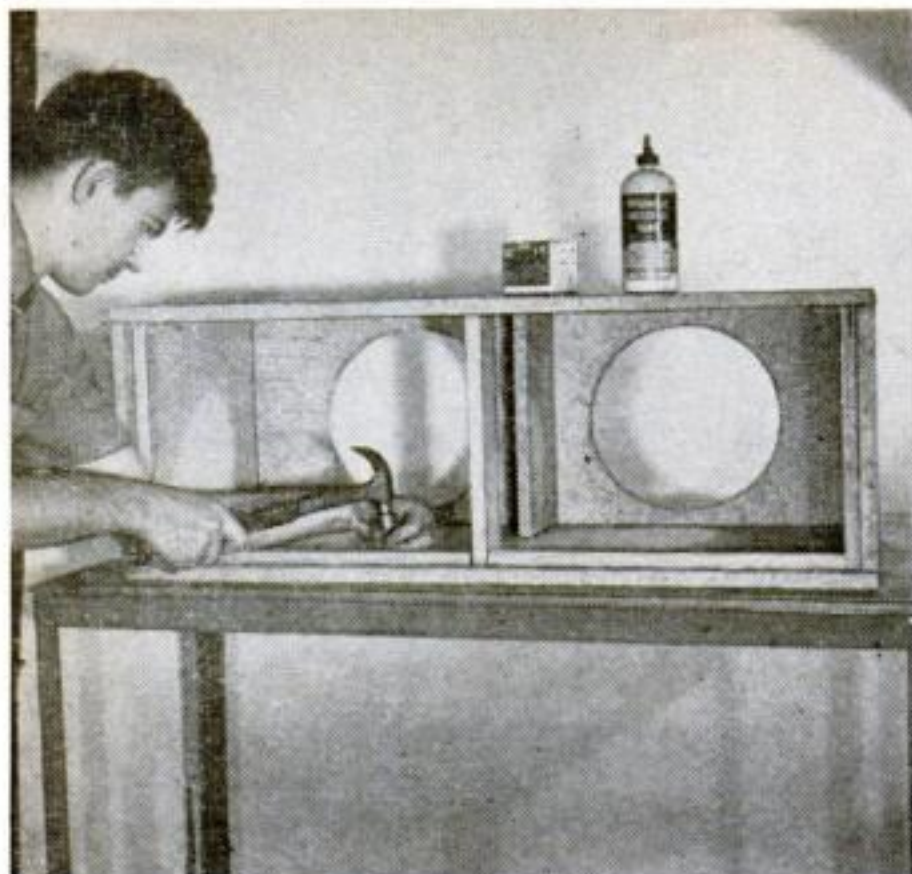
*. . . Or lift them out for placement
elsewhere in the room.*

higher frequencies that give us the clue to sound direction. It is almost impossible to tell which direction a sound is coming from when the frequencies are below about 400 c.p.s. (cycles per second). Thus, if the sources of the higher frequencies are well separated, it won't make much difference if the low frequen-

CONTINUED

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The only critical construction is the woofer cabinet;



CLEATS ARE GLUED AND NAILED inside, all around, $\frac{3}{4}$ " from the edge; these secure the back panel. Glue all panel joints and use nails or screws to keep them tight while the glue sets.



BEFORE CLOSING WOOFER CABINET, loosely fill space back of speakers with fiber-glass chunks. Fit back panel in place, driving screws through it into cleats and rear center-brace.

cies from both stereo channels originate in the same enclosure.

This is the secret behind the remarkable sound produced by our satellite speaker system. All frequencies below 350 c.p.s. are channeled to twin woofers in the one bass-reflex enclosure. Since it's the low frequencies that require a large enclosure, the high ones can be

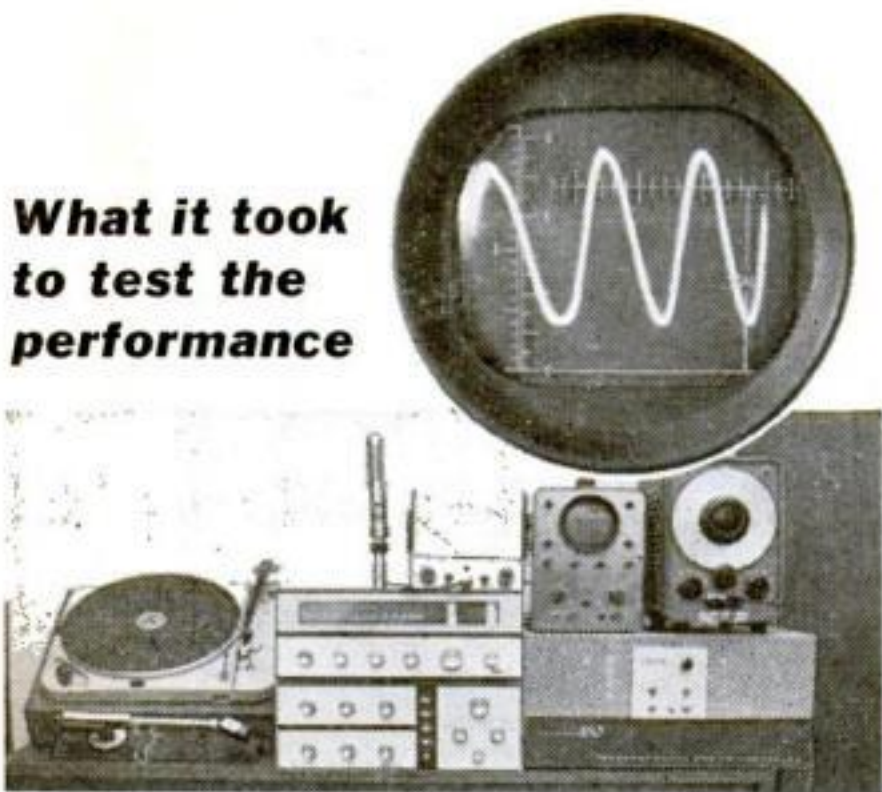
handled by speakers in small baffles.

The satellites can be moved anywhere in the room (within the limits of their extension wires) to obtain the best stereo effect. For storage—or lazy listening, when you're willing to settle for less than maximum effect—sit the satellites in their niches at either end of the woofer enclosure.

Lots of glue. Butt joints were used in the construction. If you favor fancier joinery, be sure to keep to the basic dimensions for the main enclosure. These were arrived at after much trial-and-error testing. They assure top performance with the speakers specified. All joints must be tight. Apply plenty of glue, and fasten with nails or screws at 4" intervals. Use $\frac{3}{4}$ " Novoply for the enclosures. These wood-chip panels are more inert than plywood and seem to have less panel vibration. If you're budgeting for sound—not looks—you can omit the natural-finish hardwood panels that bracket the three speakers. But remember that you'll lose the niches for the satellites.

The 12" speakers are high-quality imports designed for service as woofers. Their top frequency response is about 3,000 c.p.s., and free-air resonance about 30 c.p.s. Other woofers with similar

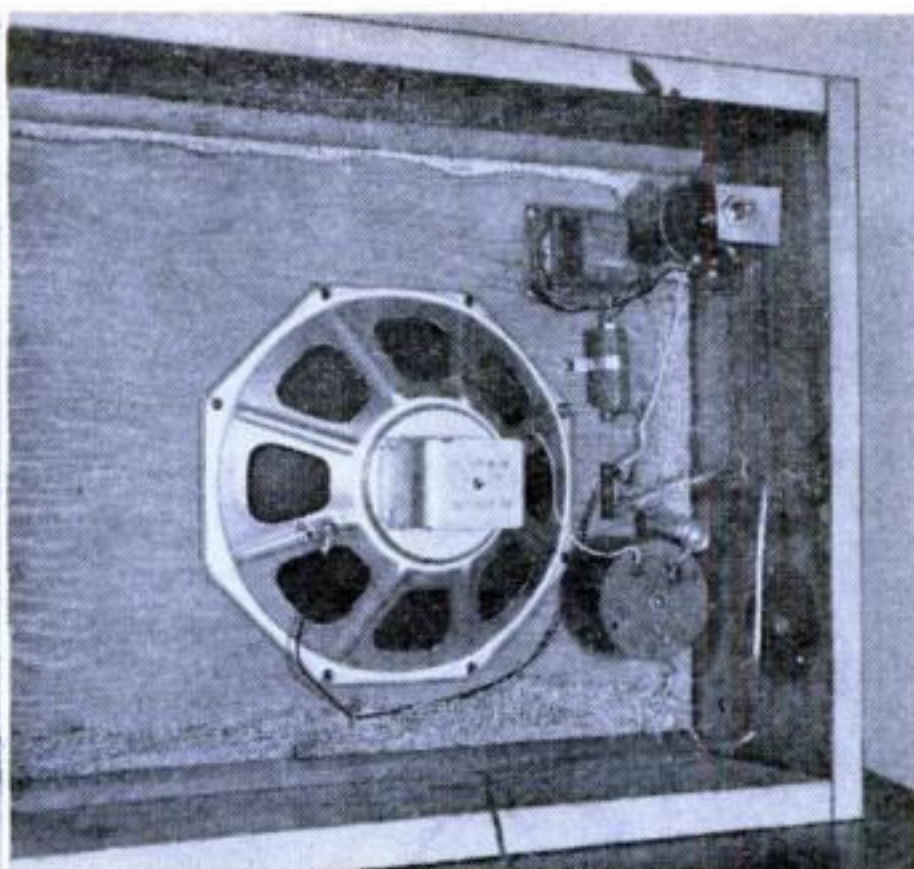
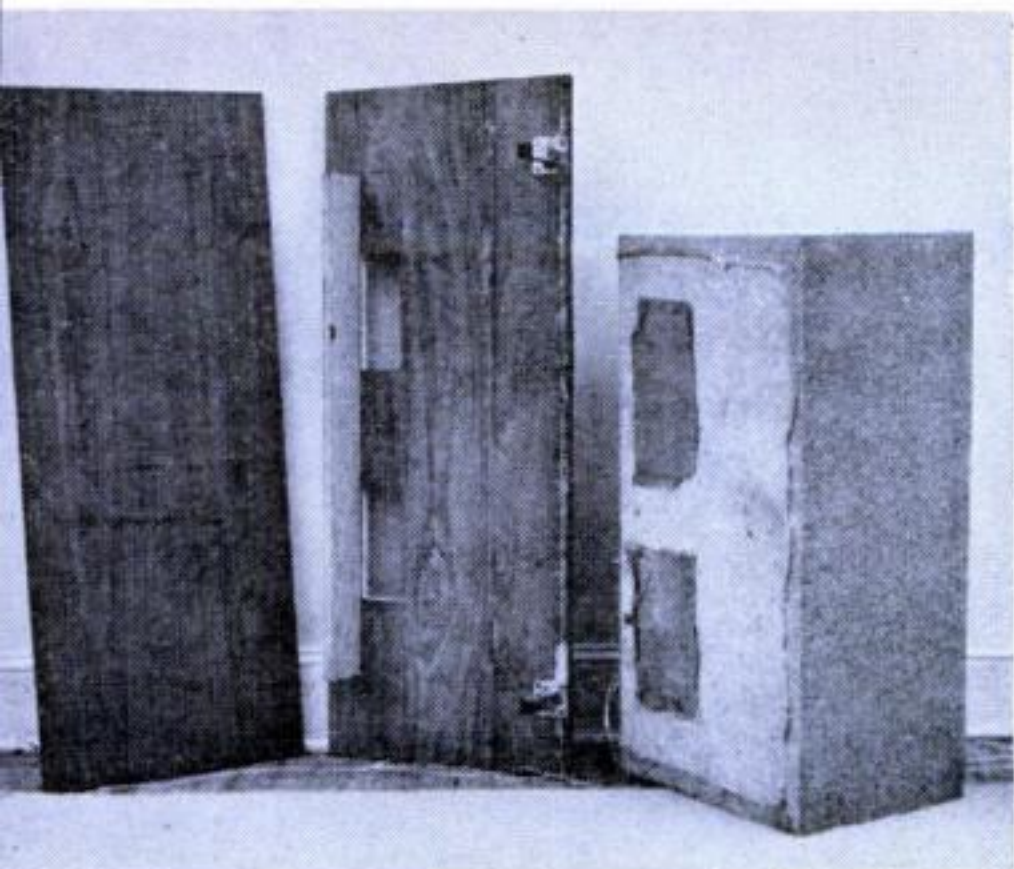
What it took to test the performance



HIGH-QUALITY SOUND depends on precision mating of speaker and cabinet. Here's the hi-fi equipment and test instruments used to check out our system. Oscilloscope shows 35-c.p.s. wave form picked up by mike in front of woofer cabinet. Lack of distortion shows system's ability to reproduce low bass frequencies.

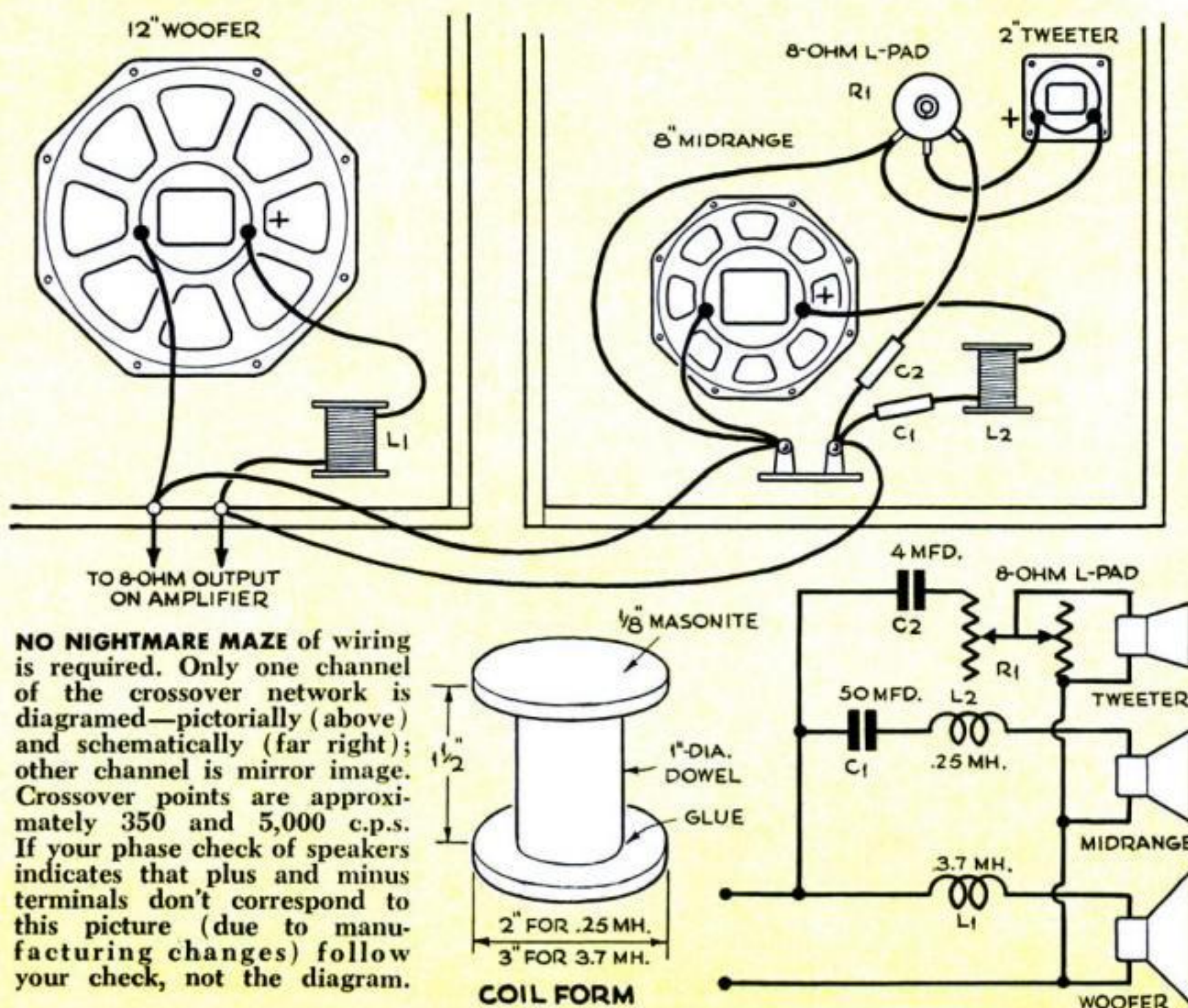
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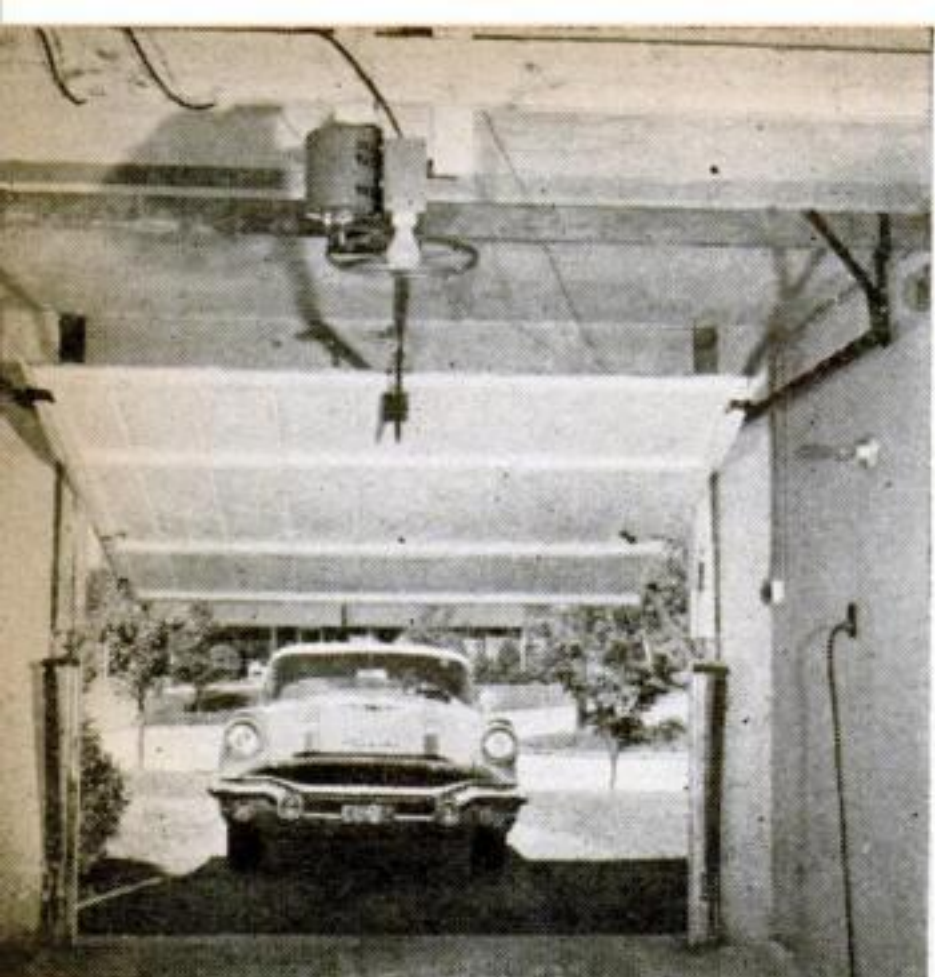
the satellite enclosure (far right) couldn't be simpler



ENCLOSURES AREN'T FASTENED to hardwood panels, but are sandwiched between. When centered, woofer-cabinet ports align with those in base. Panel behind ports supports rear.

SATELLITE CABINET IS BACKLESS: Right-hand unit is shown; left one has components in reverse. Satellites are in proper niche when tweeter is nearest the front of the woofer cabinet.





The Strange Doings of My Garage-Door Operator

The mechanism I assembled from a kit works fine now —since I figured a way to foil those three a.m. ghosts

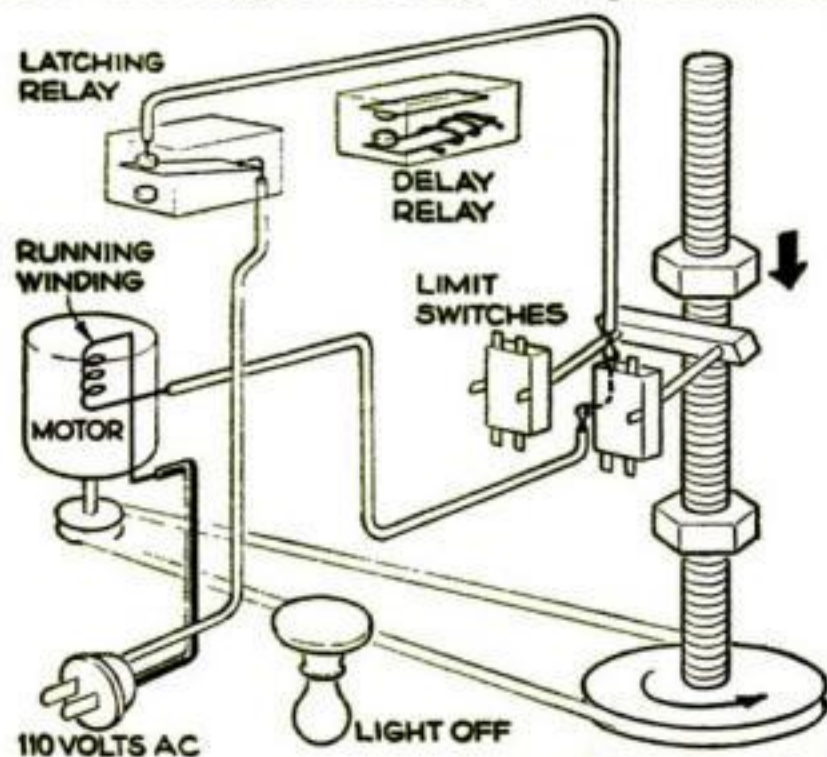
By Harry Samuels

I SAVED about \$50 by assembling a radio-controlled garage-door mechanism from a kit. The fun I got out of the delightful gadgetry would have made it worth while even without this saving. It has also furnished our household with an intriguing mystery.

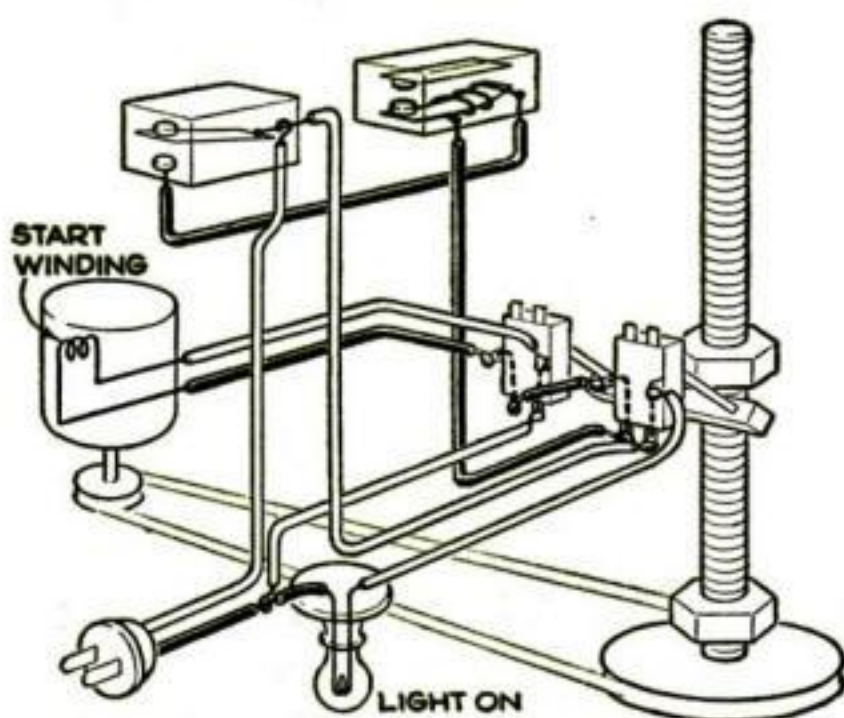
Everything needed to open and close a door by radio control comes in the kit (Heathkit Model GD 20, \$110 F.O.B. Benton Harbor, Mich.). There's a two-tube transmitter for the car, a matching receiver for the garage, and drive machinery powered by a 1/4-hp. motor to raise and lower the door.

A valuable extra is a safety release

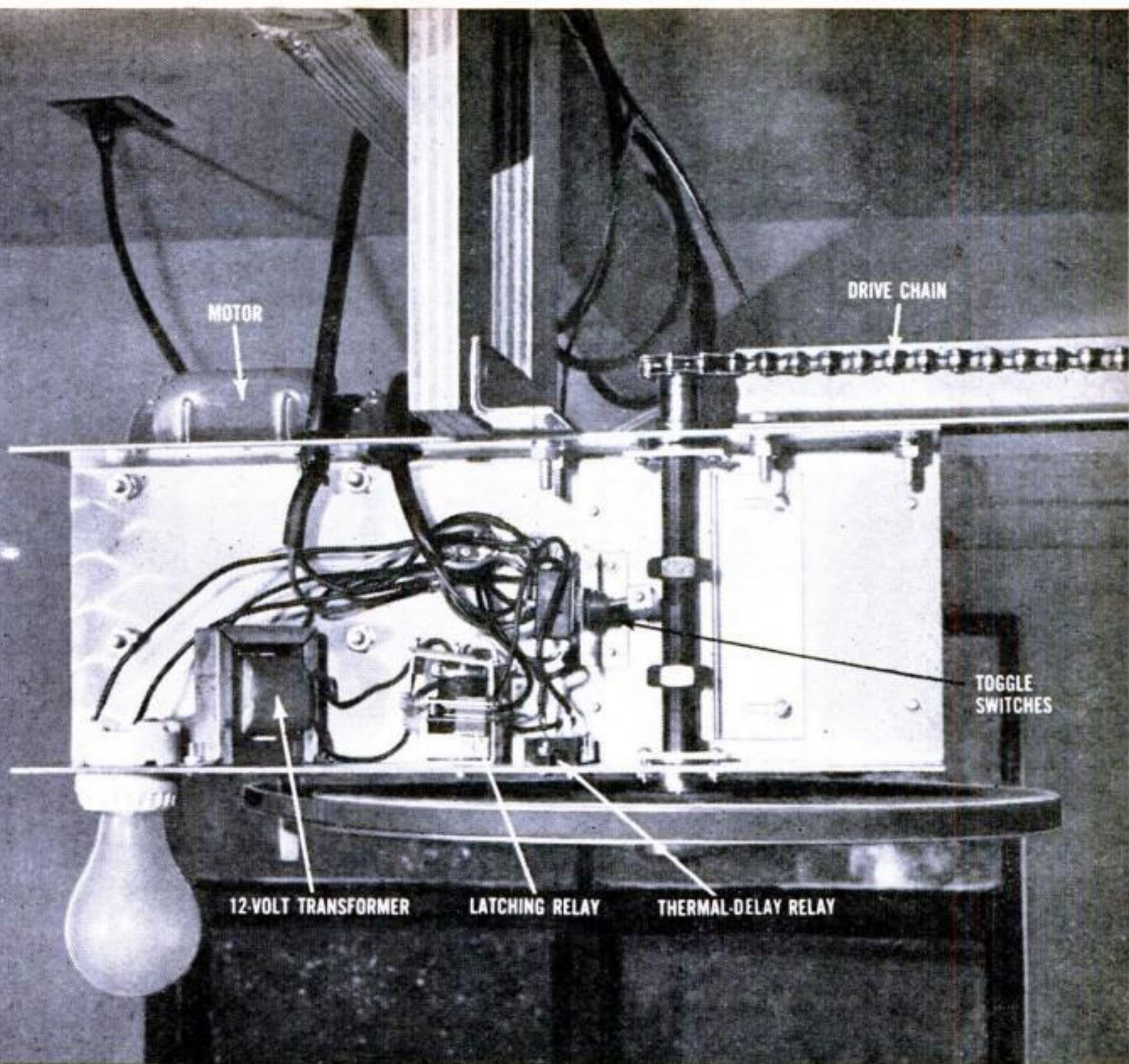
How an ingeniously simple mechanism opens and closes the door



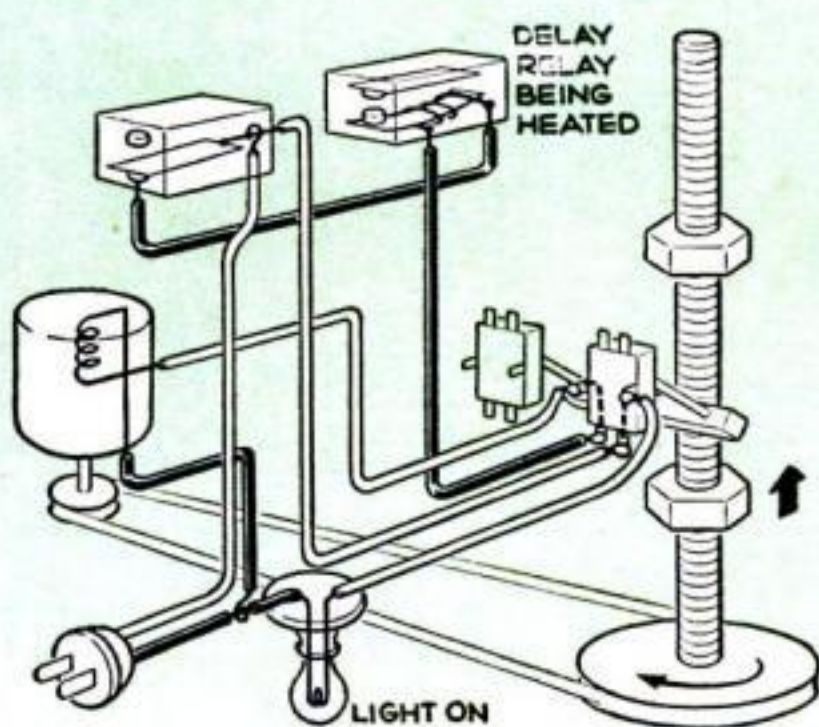
1 OPENING: With door rising, toggle switches feed current to motor's running winding. As threaded drive shaft turns, two hex nuts, kept from turning by a bracket, ride down.



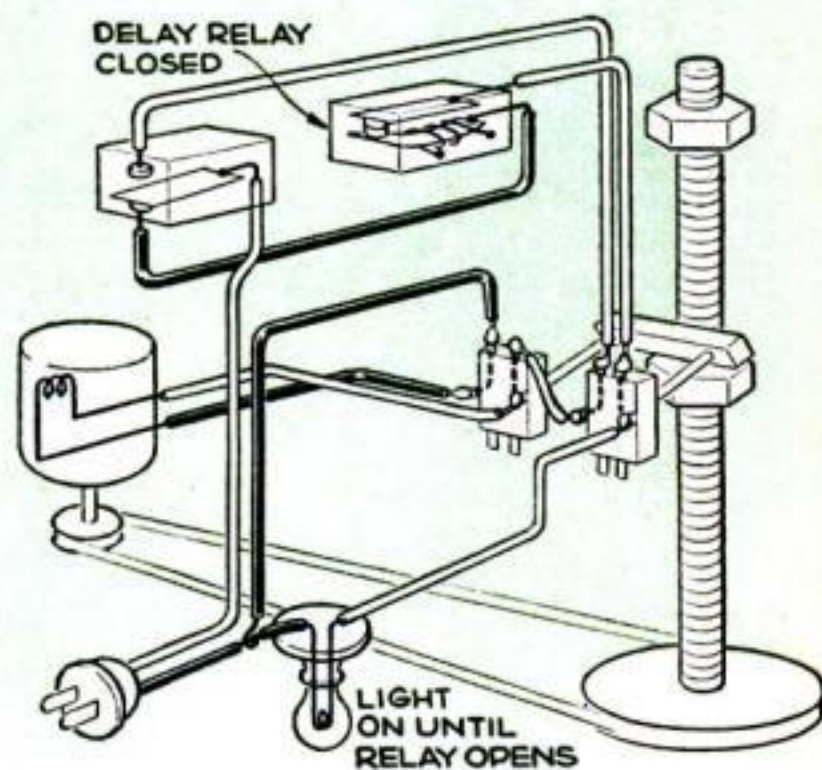
2 FULLY OPEN: When upper nut reaches bar on switches, it flips toggles the opposite way. This stops the motor and at same time reverses the connections to its starting winding.



Ceiling-mounted receiver shows nuts on threaded drive shaft that flip limit switches (below).



3 CLOSING: Next triggering feeds current through reversed toggles, and motor lowers door. Hex nuts now ride up. Motor draws current through thermal-delay relay to heat it.



4 CLOSED: Lower nut now flips toggles back to stop motor and reverse circuit for next upward cycle. Light stays on for few minutes until thermal-delay relay cools and opens.



The door stops in its tracks if anything gets in the way

CHAIN-DRIVEN TROLLEY rides back and forth on overhead T rail, pushing door open in the forward direction, pulling it closed toward the rear. A notched link in the chain is held in the trolley by force of two delicately set coil springs, seen above at left. If anything gets

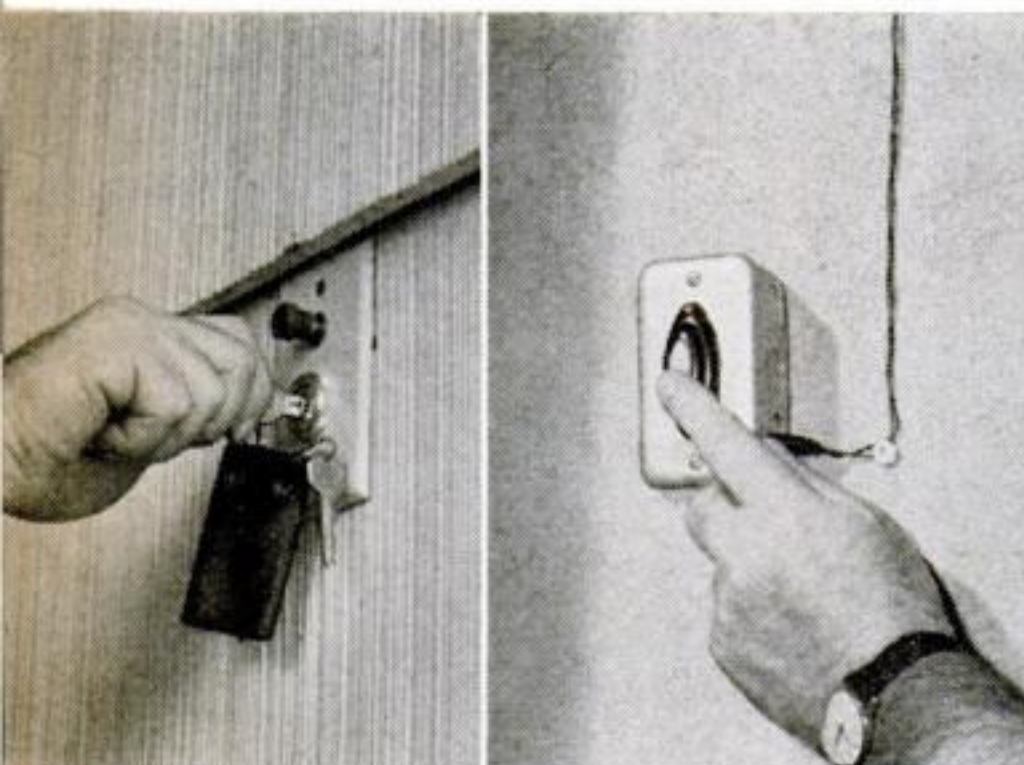
caught under the door—even a small child or animal—it takes only slight pressure to slip the notched link out of the trolley. The link, visible at right, then continues on, but the trolley stops within a fraction of a second, safely holding the door up and preventing injury.

that disengages the drive if something gets in the way of the door. A momentary contact switch allows operation of the door independently of the transmitter. I mounted this inside the garage. Later I added another pushbutton outside since the only access I have to my garage is through the main door.

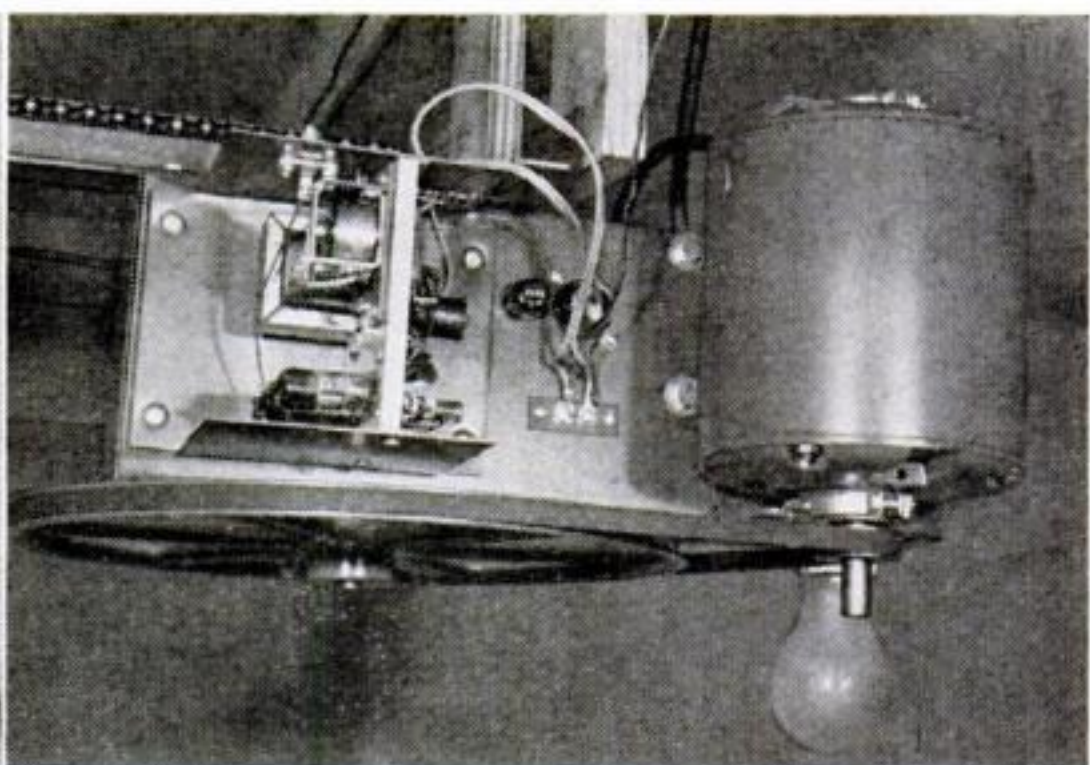
Now about that mystery: After I had gotten everything operating nicely, I was awakened at three a.m. by the clank of the chain drive, opening and closing the door. This spooky voluntary

operation continued at odd intervals—sometimes two or three times a week. I still haven't found a logical explanation. One of my more imaginative electronics-type friends suggests that it may be triggered by a passing satellite.

Since I knew no way of guarding against the whims of space craft, I arranged to lock 'em out. I wired a key-controlled switch into the power line (Lafayette SW-75). When I'm through with the car for the day, I turn the key and sleep in peace. ■ ■



LOCKING OUT GHOSTS: Key switch, mounted outside garage, enables entire mechanism to be shut off at night or during vacation time to keep stray signals from triggering door. Pushbutton above key closes 12-volt relay manually so door can be operated independently of car's transmitter. Second pushbutton, at right, permits control of door from inside garage.



RADIO RECEIVER on garage ceiling reacts to pulse from car's transmitter by closing 12-volt relay. This then switches on house current to run motor that opens and closes the door. Pushbuttons at left are also wired to 12-volt relay so door can be operated manually. Motor belt-drives large pulley, which in turn drives the chain to raise and lower the door.



The man in the wreck lay dying. Martin ran for his mike. Could a call get through?

There's drama in the air nowadays on the Citizens Band—

The Radio Party Line

By Paul Daniels

A SEDAN sped around John Martin's VW on the icy parkway and, before it could stop, slammed into the unseen rear of a slow-moving snowplow. Martin skidded to a stop and ran to the wreck. The driver was slumped over the wheel.

Martin looked up and down the highway. No help was in sight. The plow, its driver apparently unaware of the crash, had disappeared. Martin dashed to his car, grabbed the microphone of his Citizens Band two-way radio, and put out a general call for help on channel 3.

A woman tending office for her plumber husband relayed the call to the state police. In minutes an ambulance roared onto the scene. The intern told Martin his fast action had saved the man's life.

This was only one of many small acts of service now performed by some 200,000 Citizens Banders every day—acts that amply justify the creation of the 27-megacycle, Class D Citizens Radio Service by the FCC in September, 1958. In the short time since then, the CB airwaves have become almost one big party line, filled with voices jabbering, arguing, interrupting, and generally helping each other in a common cause. You can reach almost anyone anywhere with a CB

rig—if not directly, then by having your call relayed by one unknown friend after another to its final destination. Already, CB has more than twice as many licensees as 50-year-old amateur radio.

The cost to get on the air is as low as \$40 for a kit or close-range handie-talkie, \$60 for an assembled transceiver (transmitter and receiver in one unit, sharing some circuits). And best of all, no technical knowledge is required, no tests need be passed.

A license is issued by the FCC to any U.S. citizen over 18 who fills out an FCC Form 505 and shows legitimate reason for desiring CB. The form may be obtained from and returned to the FCC, Washington 25, D.C. There's a six- to eight-week wait at present.

Help for travelers. But as important as CB radios are in emergencies, most Citizens Banders get their biggest kick from the personal aspects of their growing club. Bill Stevens was driving south along Route 13, heading for the ferry to Norfolk, Va. He suddenly wondered if the ferry was running so late in the year after Labor Day. He flipped on his CB rig and put out a general call on channel 9. No sooner had he released the push-to-talk button on his mike than a precise voice shot out of his speaker volunteering help. It was a retired army

CONTINUED

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officer who not only knew the exact ferry schedule (yes, it ran all year) but also the best way to get to the ferry.

Trouble developed when Stevens asked advice about a good restaurant in the neighborhood. As soon as the officer gave his suggestion, two other CBers broke in and warned Stevens away from the place. They each knew a better hash house. Finally all three settled on a local seafood restaurant and one even offered to lead him there.

For businessmen, too. A high percentage of Citizens Band licensees use two-way radio for business: TV servicemen, small electrical and plumbing contractors, taxi owners, truckers, marina operators, and salesmen. It's proved ideal for immediate and constant communications within an area of up to 20 miles. Hills and built-up areas cut down on this distance (27 megacycles is v.h.f and limited to line-of-sight range).

One enterprising service station run by George Lombardo near Stamford, Conn., installed CB equipment in its three road-service jeeps to route them from call to call. Customers quickly passed the word around that Lombardo's station was on the Citizens Band. Soon, Lombardo began getting calls directly from CBers who were stuck in the snow, or out of gas, or helping someone else on the highway. Now, 1W4916 in Stamford is a remembered call for all motoring CBers in need of help.

Paul D., 2W4233, was idly listening to the action on channel 7 late one afternoon, when he heard his call letters sounded by a friend in Westport, Conn., about eight miles away. He answered the call and was told that his friend's daughter was about to give birth. Her husband, a salesman, was on the road somewhere in New Jersey and they wanted him back. The husband had a Citizens Band radio in his car. Would Paul help set up a relay to reach him and get him home?

Paul immediately sent out a call to fellow CBers closer to New Jersey and asked them to pass it on. The father-to-be was contacted in his car near Clifton, N.J., and told to call his father-in-law's house immediately. He did, was told to rush directly to the hospital, and got there in time to beat the arrival of his first son.



HOW TO MAKE

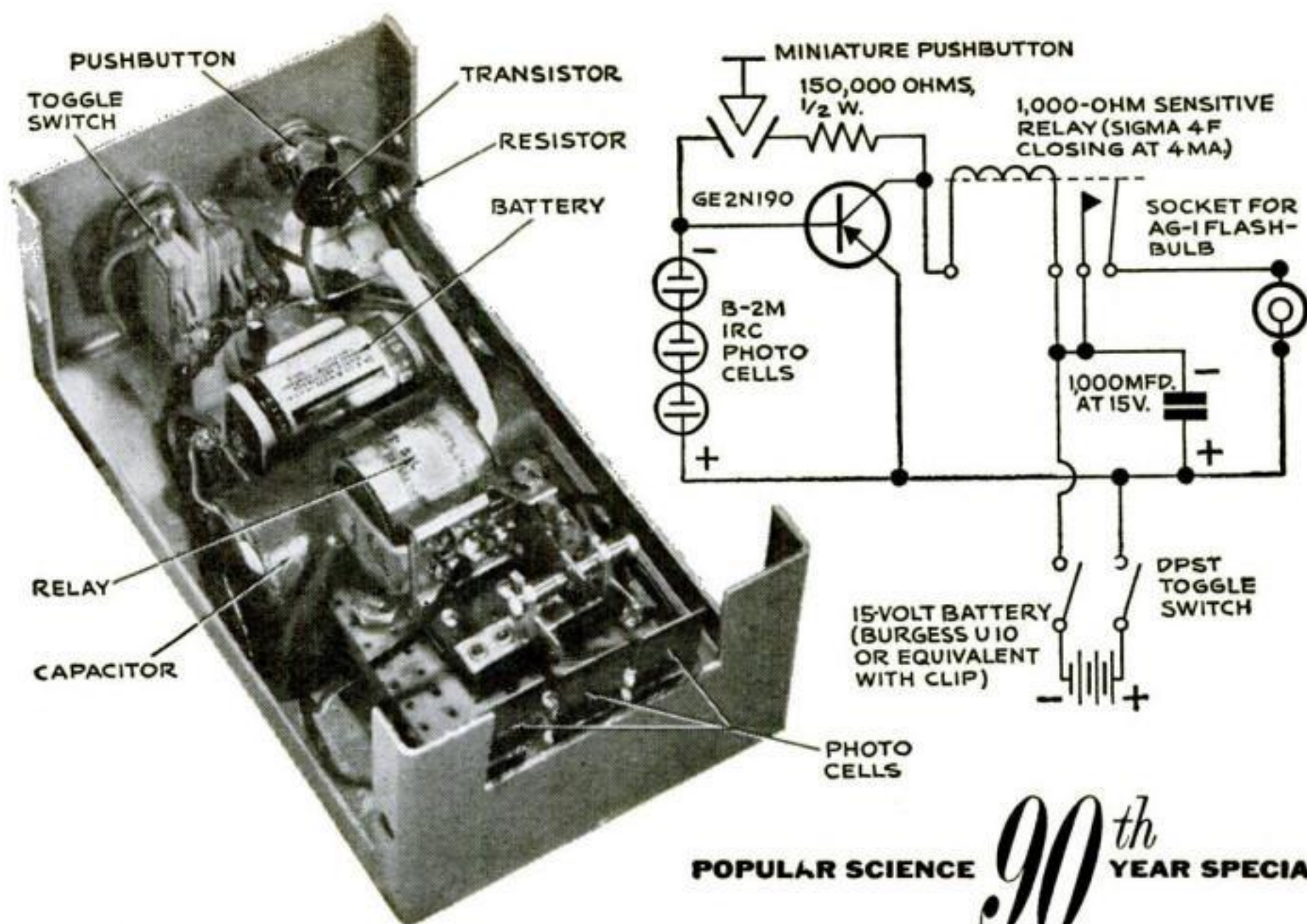
A Transistor Slave Flash

By Steven Hahn

TRIP the flashgun on a camera and this little electric-eye slave automatically fires a second flashbulb off in the distance, giving instant room-filling illumination. Not only does it eliminate those stark, flat, front-lighted shots, but it does it without a single wire. There's nothing between you and the slave. All you have to do is feed it fresh flashbulbs.

Magic? Almost. Three tiny photo cells pick up light from the main flash and trigger a miniature transistor circuit so fast that the slave bulb fires almost simultaneously. Because the slave doesn't rely on power from the camera, any number of units can be used together for multiple-flash work. It also enables you to add remote flash to cameras not equipped with extension outlets.

Total cost: less than \$15, plus a few hours' work. The powerful AG-1 bulbs



POPULAR SCIENCE

90th

YEAR SPECIAL

used in the slave are so small you can carry a couple of dozen in a shirt pocket.

How the slave works. The three photo cells are wired in series across the base of a transistor that acts like a switch. It's biased in such a way that it won't pass current under normal lighting, but will pass it under the sudden surge of a flash. This trips a sensitive relay, which in turn discharges a capacitor to insure fast, complete firing of the slave bulb. The relay then opens and the capacitor is recharged by a 15-volt battery for the next shot.

A pushbutton lets you check the slave with a nondestructive test bulb. It inserts a bias resistor between the transistor's collector and base, causing it to fire as if the photo cells had been energized. Thus you test not only the battery, but the entire circuit. There's also an on-off switch so the slave can't fire accidentally.

The AG-1 bulb holder is a standard adaptor with a reflector. This fits into a single-contact, bayonet-type candelabra socket available from electronics-supply houses. The socket is mounted with a bent tab on a rubber stand-off so you can swivel the bulb in any direction.

Wiring the circuit. All parts fit into an aluminum box 5½" by 3" by 2½". Cut a 1"-by-2" window in the edge at one end for the photo cells. The mounting tabs on the cells are carefully bent to a right angle and bolted, along with the relay, to a scrap of transistor-mounting board 2" by 1¾". The board is spaced away from the box with washers on two machine screws so you can adjust the height of the photo cells to match the window.

The pushbutton and on-off switch mount in the opposite end of the box from the window, and the capacitor and battery clip go on the lid. The transistor and resistor are soldered directly to the pushbutton. Take care not to overheat and damage the transistor during the soldering.

Using the slave. Aim the photo cells so they receive maximum light from the master flash. They'll work up to 20 feet away in a darkened room, a bit less in bright light. You can use speeds up to 1/30 second on X and F sync and up to 1/125 second on M. (Electronic flash is too brief to trigger the cells.) In very bright light, keep the cells aimed in shadow so they won't fire prematurely.

Should You Buy an FM Car Radio?

by Len Buckwalter

ON THE highway, FM has been a slow comer. But with the boom in FM radio generally, set manufacturers are now scrambling to make up for lost time. You'll be more and more tempted by appealing claims for the delights that can be yours with an FM radio in your car:

"Static-free, hi-fi sound; fewer commercials; better programing"—are promises intended to induce you to look past the fairly healthy price tags. Is it worth it? For many, the answer is enthusiastic agreement; but others will find car FM of limited value. If you are one of the tempted, it will pay you to examine those alluring claims before you buy. Here's how they check out:

- *No static:* FM loses its immunity to noise as you drive away from the transmitter. We began our tests 45 miles from a group of metropolitan stations. At this distance, the ability of FM signals to silence atmospheric noise proved marginal. Also, the sputtering sound of ignition noise generated by other vehicles marred reception.

Much of the noise problem tends to disappear when you move in to the 30-35-mile range. But, it's still with you. FM is subject to a type of fast fading known as "flutter." The waves bounce and reflect off various surfaces and strike the car antenna in unpredictable patterns. Expect some of this effect in hilly or built-up areas, less in open country.

Reception dramatically changes inside the FM stations' primary service area. This usually ends about 25 miles from the transmitting point. Within this range the sound is solid, static-free, and shows car FM to its best advantage.

- *Works in short tunnels and under bridges:* It's best to consider FM's ability to deliver steady volume under these circumstances as a bonus, not something you couldn't live without.

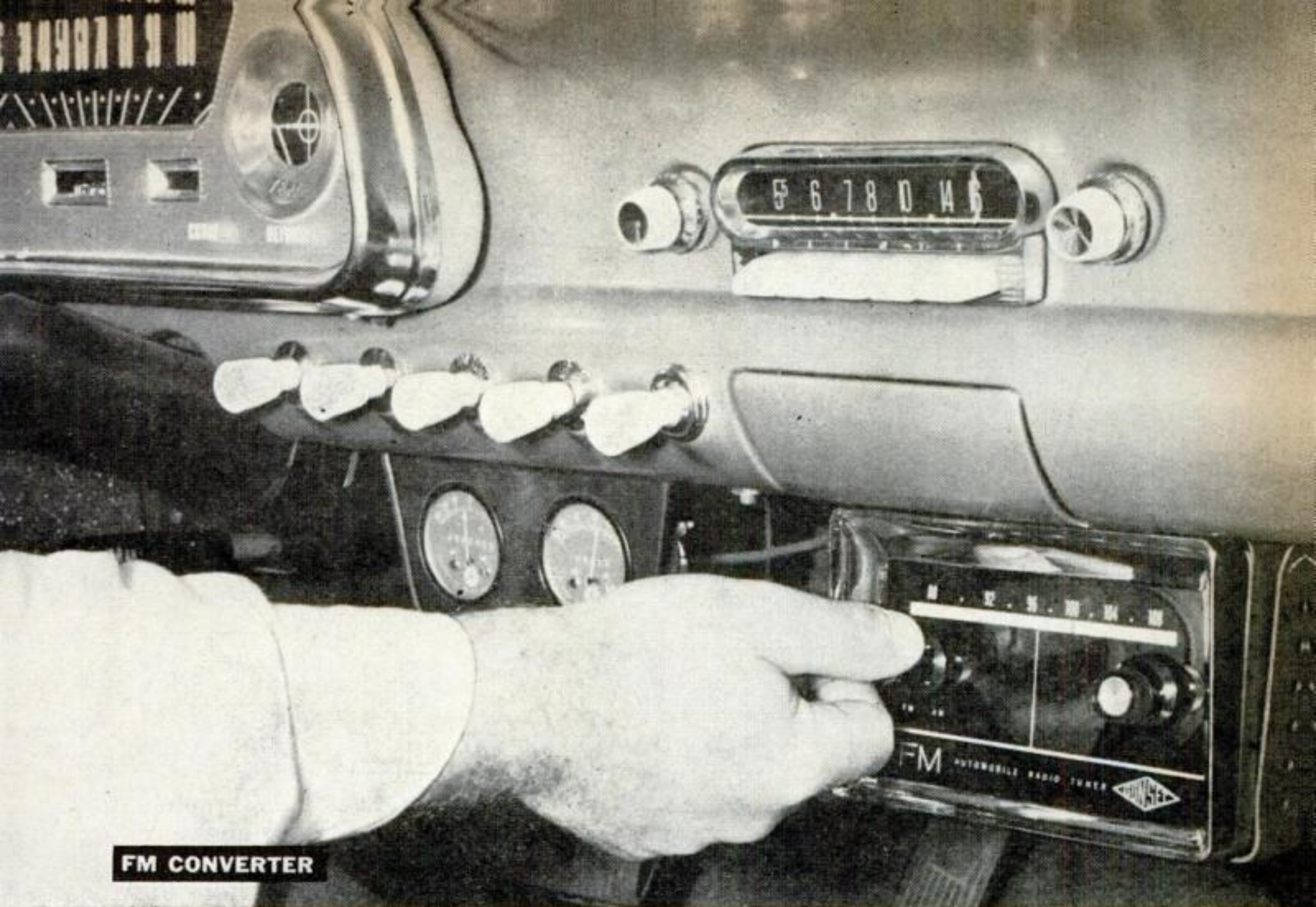
- *Fewer commercials:* Yes, but their number is increasing as the success of FM attracts more sponsors. Nevertheless, the length of many of the musical selections aired prevents the barrage of spot announcements common to AM radio.

- *Hi-fi sound:* Some sets make a close swipe at hi-fi. Whether you get it or not depends chiefly on your choice between

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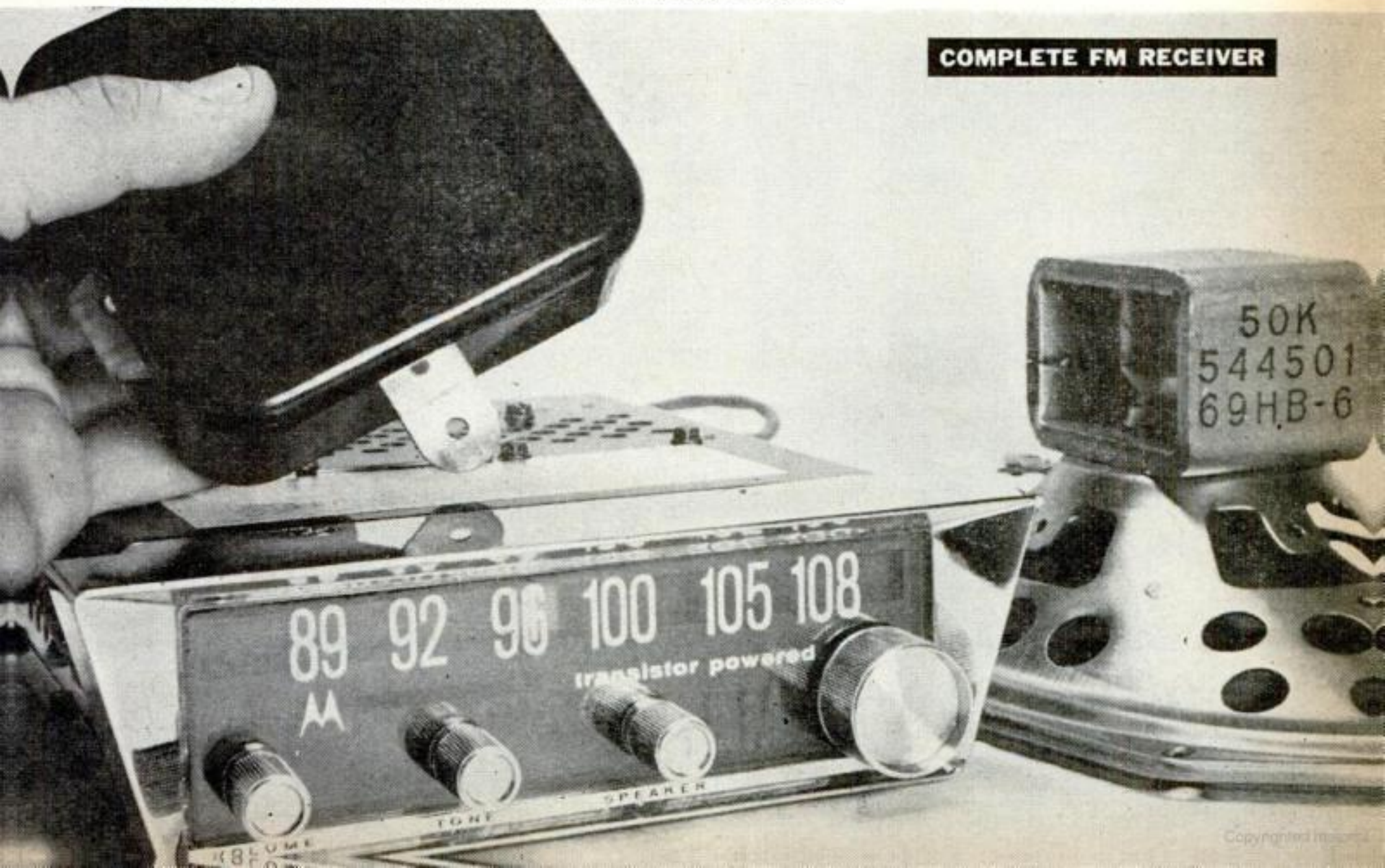
You Have a Choice of Three Types





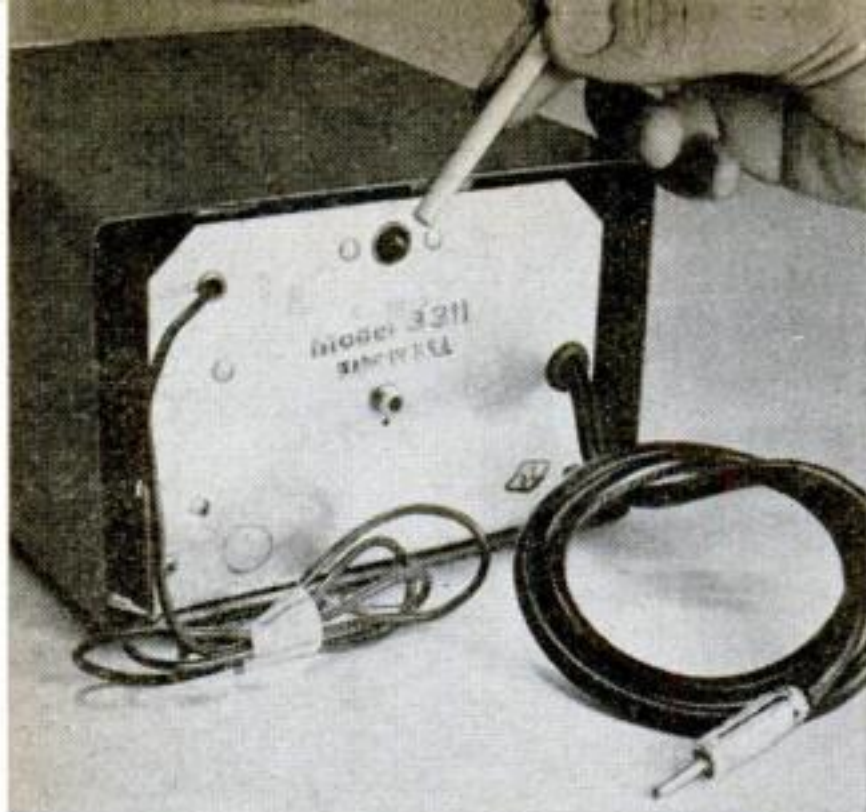
FM CONVERTER

THREE TYPICAL FM SETS illustrate the range of equipment available. The Gonset converter, above, mounts underneath your AM radio and operates through its speaker: \$79.50. The Blaupunkt, below, left, a combination set that replaces your AM set, has two pushbuttons for AM, two for FM, and one for marine band: \$150, plus \$18 installation kit. Motorola, below, is underdash FM, independent of car's AM radio. Hand holds power pack; at far right is rear-seat speaker. This set is \$125, complete.

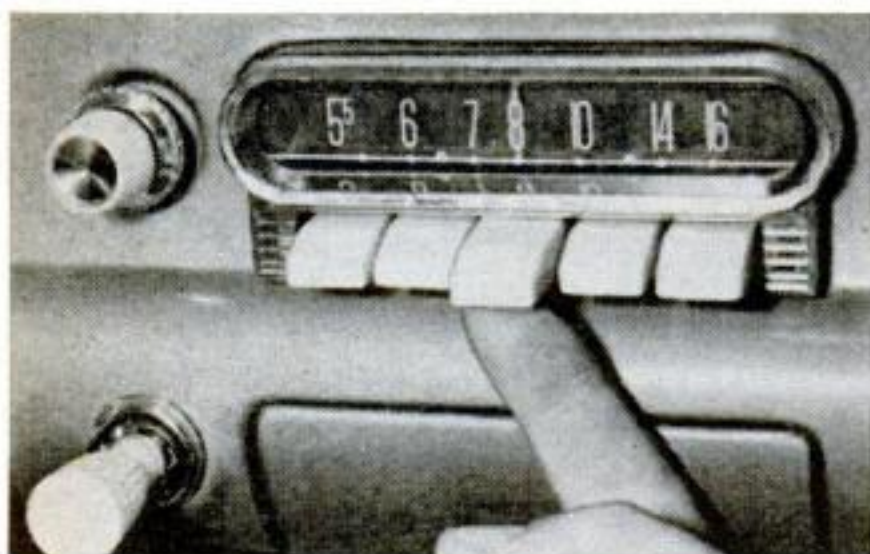


COMPLETE FM RECEIVER

50K
544501
69HB-6



REAR VIEW OF CONVERTER shows (pointer) jack for plug from car's antenna. Thick cable connects to antenna jack of AM radio; thin one picks up 12-volt power from ignition switch.



YOU SET ONE PUSHBUTTON on AM dial to frequency maker recommends for picking up signal from converter (usually around 800 kilocycles). To set, tune dial, pull button out, as shown.



NO SPECIAL ANTENNA is needed for FM; standard AM type serves both. But FM signals "peak" best if antenna is adjusted to 30" height.

two categories of equipment: the converters or complete FM radios.

Making use of what you've got. The converter works through your regular car radio. It tunes in FM stations and converts their signals down to the standard broadcast band. The car radio is electronically deceived into believing that it's picking up an AM station at around 800 kilocycles.

The attraction of the converter is low price (it makes use of circuits already in the car radio). But there's an important limitation you should be aware of. The converter puts high-quality signals *into* your radio, but the sound coming out is not significantly better than what you already have. Most car radios simply do not have the circuits or speakers to fully benefit from FM quality. Thus, the converter should suit you if you want to receive programs not broadcast on the AM band—and aren't after any great improvement in fidelity.

Starting from scratch. The complete FM radio with its own circuits makes a close approach to hi-fi. Audio stages are more elaborately designed to handle the wide tonal range of FM. The effect in an automobile is startling. With a good speaker, sound is reproduced with clarity and brilliance that make AM muffled by comparison. The complete set is a more expensive package, but has plenty of appeal if you're willing to pay for superior performance in the direction of hi-fi.

Whether a converter or complete radio is your choice, a rear-seat speaker is a virtual necessity. Standard dashboard speakers are often small, poorly enclosed, and incapable of reproducing much of the sound fed to them by the rest of the equipment.

Special antennas? Early in the brief history of car FM it was believed that specially designed antennas would be needed for good reception. In fact, one of the first sets to appear included a plastic-enclosed wire that you attached to the windshield. The trend now is toward the standard telescoping whip—the same one used for AM reception. Manufacturers equip their sets with a convenient switching arrangement so that the regular whip antenna can be shared by AM and FM.

Weigh all the factors. Armed with an idea of range and performance on the

[Continued on page 220]



KEEP YOUR CHEVY the CHEVY-EST* ... specify a genuine GM Chevrolet replacement muffler

Naturally you care what parts go into your Chevrolet—because your Chevy does! Whether you do your own routine servicing or have it done, the important thing is to make sure you get a *genuine* GM Chevrolet muffler if your present one ever needs replacement. Like all genuine Chevrolet parts, they're built specifically for your Chevrolet. Precision built to fit right for easy, fast installation. Durably built with rust-resisting aluminized outer coating and additional aluminum and zinc inner coatings to give you long trouble-free service. They're readily available at your local Chevrolet dealer's and leading independent garages and service stations — wherever you see the familiar Genuine GM Chevrolet Parts sign.... Chevrolet Division of General Motors, Detroit 2, Michigan.



*Chevy-est: all Chevy with new-car reliability maintained part by part.



SCROLL SAW



SANDER



SHAPER



POWER PLANE

This new Router will be the busiest tool in your shop

Versatility with a capital "V"—that's what you get when you add this handsome 5-in-1 Router to *your* workshop! A single 4-amp, 23,000-RPM motor unit powers the tool as a Router, Power Plane, Shaper, Scroll Saw and Finishing Sander. And thanks to famous Porter-Cable precision engineering, you can change from one tool to another quickly, easily—in a matter of seconds.

Your Porter-Cable dealer will gladly show you how this exciting new portable tool makes plain and fancy woodworking a real "snap." Ask him for a demonstration now.

WRITE FOR FREE FOLDER describing the 5-in-1 Router and name of dealer nearest you: Porter-Cable Machine Company, Subsidiary of Rockwell Manufacturing Company, 504 B North Lexington Avenue, Pittsburgh 8, Pennsylvania.

In Canada: Porter-Cable, Ltd., Box 817, Kingston, Ontario. Canadian prices slightly higher.



How to build an Electronic Phone Secretary

By
Len Buckwalter



YOU'LL have no more worries about missed phone calls with this home-built electronic servant on the job. It automatically answers the phone for you and takes a message whenever you're out.

It uses an inexpensive home tape recorder, but permits you to use the recorder for other purposes when you wish. There is no interference with the normal use of the telephone—it needs no wiring connection to the telephone line.

How it works.

The heart of the project is an electronic unit that controls the tape recorder, "answers" the phone, and "hangs up" after the message is recorded. The device is triggered by the telephone ring. A pickup coil placed under the phone base receives energy from the ringing circuit by induction. This energy is boosted by an amplifier and operates relays that start the recorder and lift an arm pressing the phone button down. From the speaker of the recorder, a voice explains to the caller that this is a recording and he will have 30 seconds to give his message. After the message is recorded, the phone "hangs up," power to the tape machine is turned off, and the automatic secretary stands by for the next ring.

Building the control box. Wire the

circuit board, following the photos for placement of parts and the schematic diagram for correct connections. Use "flea clips" to anchor small parts and serve as wiring terminals. The finished circuit board will be mounted on four 1" spacers inside the aluminum box.

Mount the power switch (SW1), sensitivity control (R6), AC receptacle, and tape-recorder control (SOL-2) on one end of the box as shown. The plunger of SOL-2 must be free to move about

$\frac{3}{8}$ ". If farther outward travel is blocked by the edge of the box, it doesn't hurt.

Assemble the phone-button operating mechanism using SOL-1. Attach the block supporting the compression spring to the solenoid with machine screws and nuts. Mount SOL-1 to the bottom of the box with spade lugs or L brackets. Drill a hole in the end of the box for the operating arm, put the arm through it, and attach the spring. Pin the arm to the solenoid plunger and check the assembly for free operation.

Mount the circuit board and finish wiring by soldering leads to parts previously mounted on the box.

Preparing the tape recorder. Only one modification is needed inside the tape recorder: adding a linkage rod to the record-playback switch. This is quite

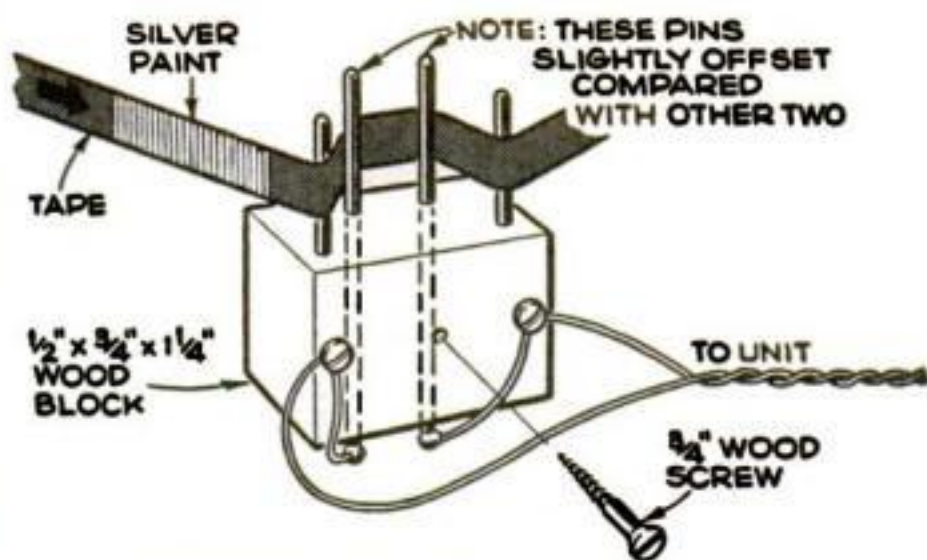
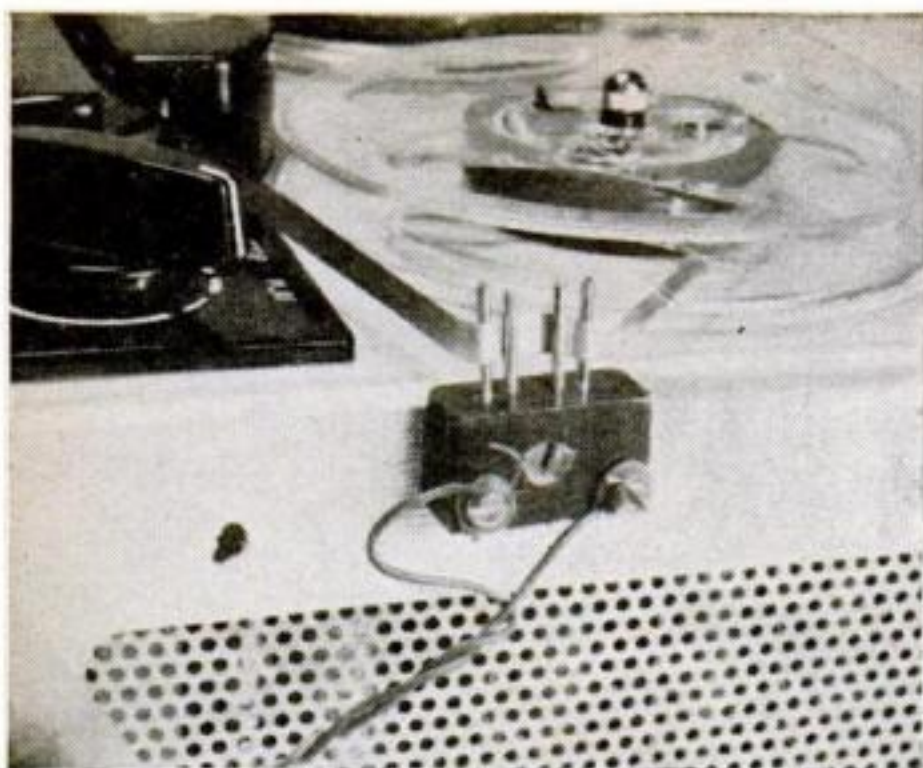
POPULAR SCIENCE

90th YEAR SPECIAL

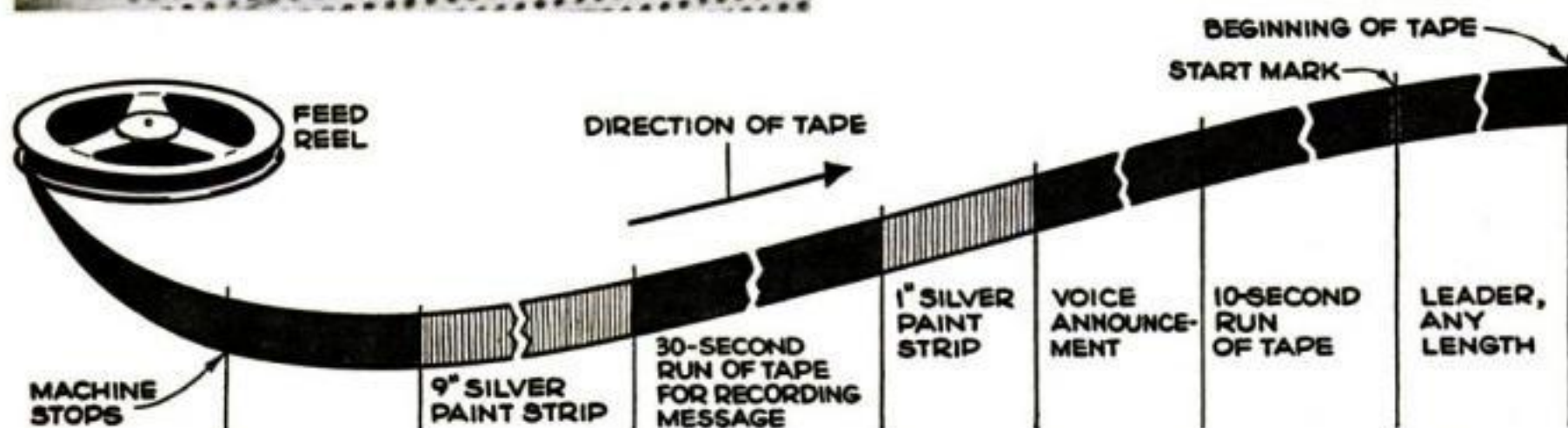
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Machine tells itself what to do next, then does it



TAPE-OPERATED SWITCH added to tape recorder signals answering unit when to change recorder from playback to record, or turn off machine. Silver paint on tape closes switch.

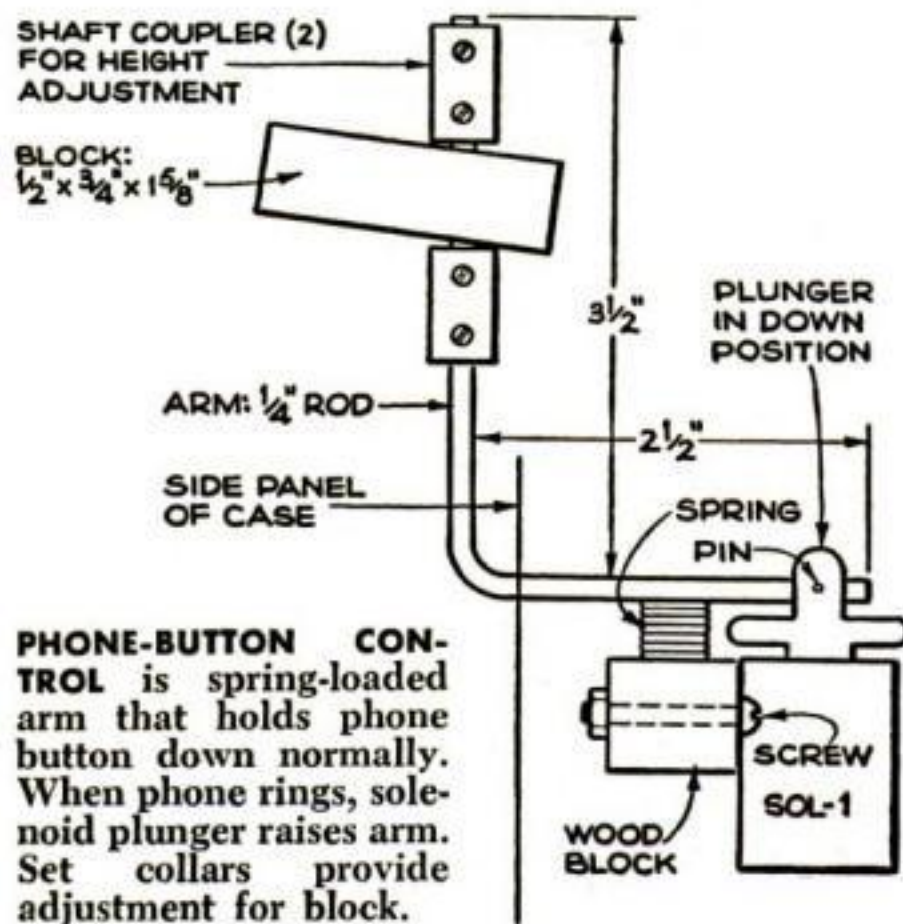
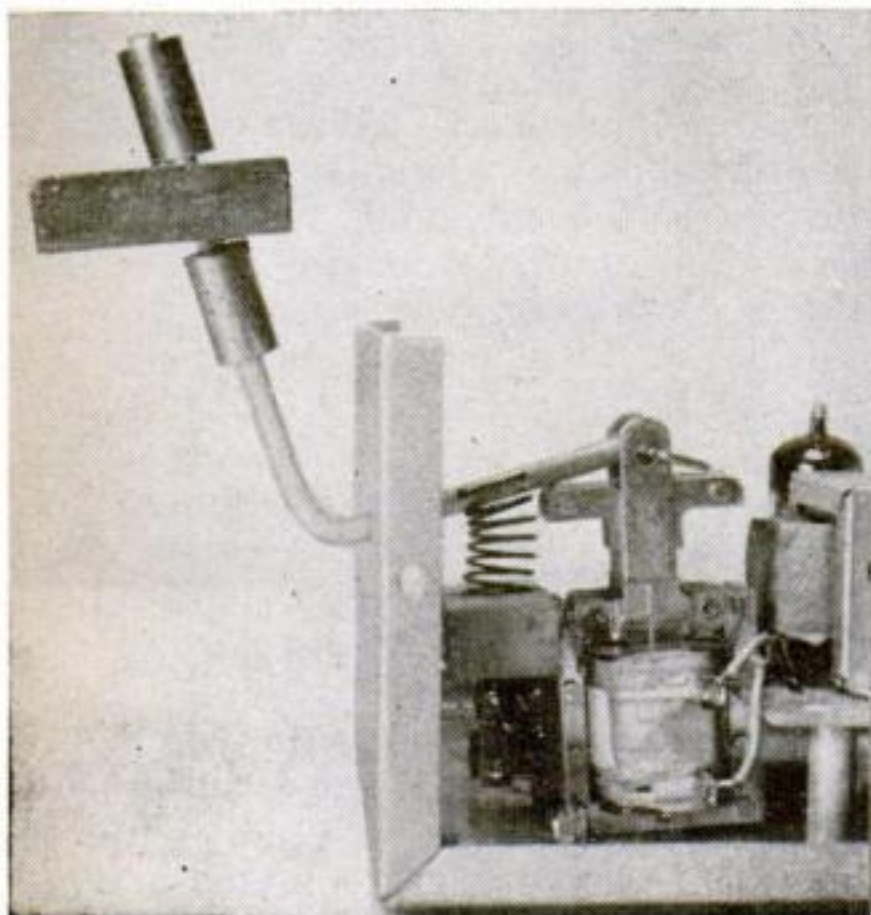


simple on the machine shown here (Lafayette RK400-WX). If you use a different tape recorder, you'll need to work out your own adaptation.

Remove the chassis from the case and loop a length of #16 copper wire through the hole already in the switch plate. Twist the wire a couple of turns and solder, so it won't come unwound. Drill a $\frac{1}{4}$ " hole in the case to line up hori-

zontally with the switch plate. Thread the wire's free end through this hole and lower the chassis back in place. The wire can be trimmed to length later.

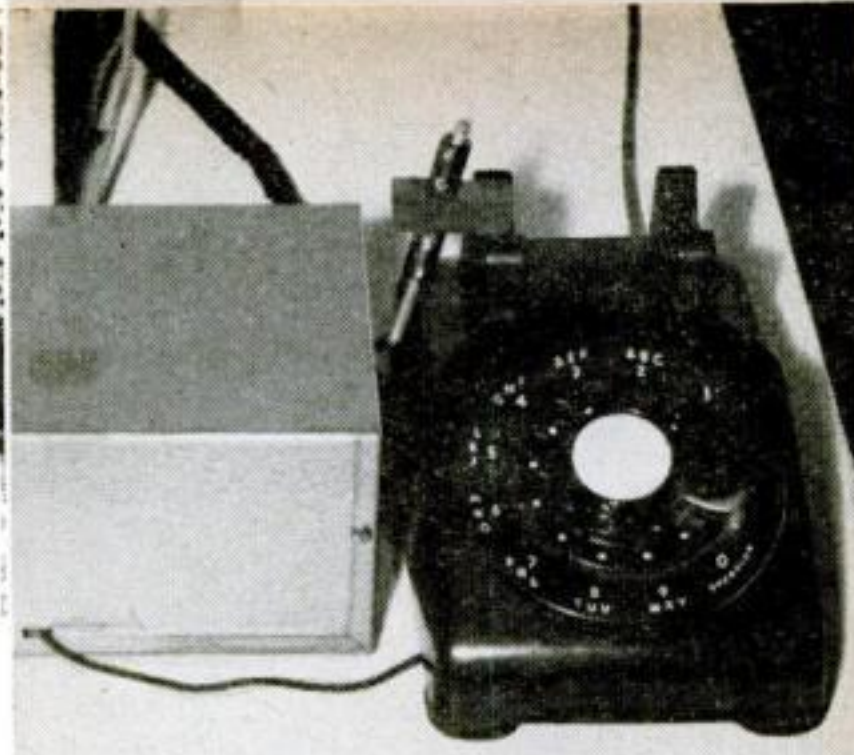
Make the tape switch (SW-2) and mount it on the right side of the case as shown above. Be sure the mounting screw doesn't short against the contact rods. Only the two inner rods form the switch contacts—the other two are guides



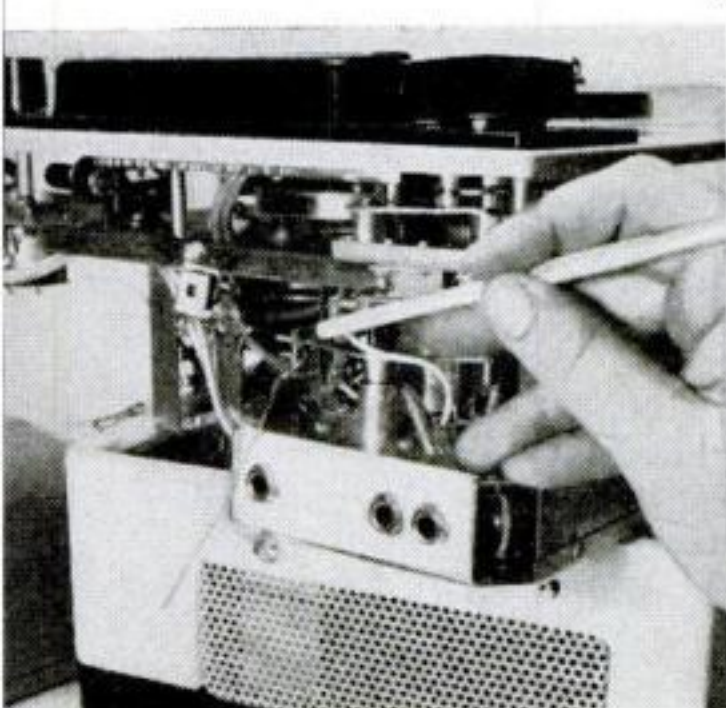
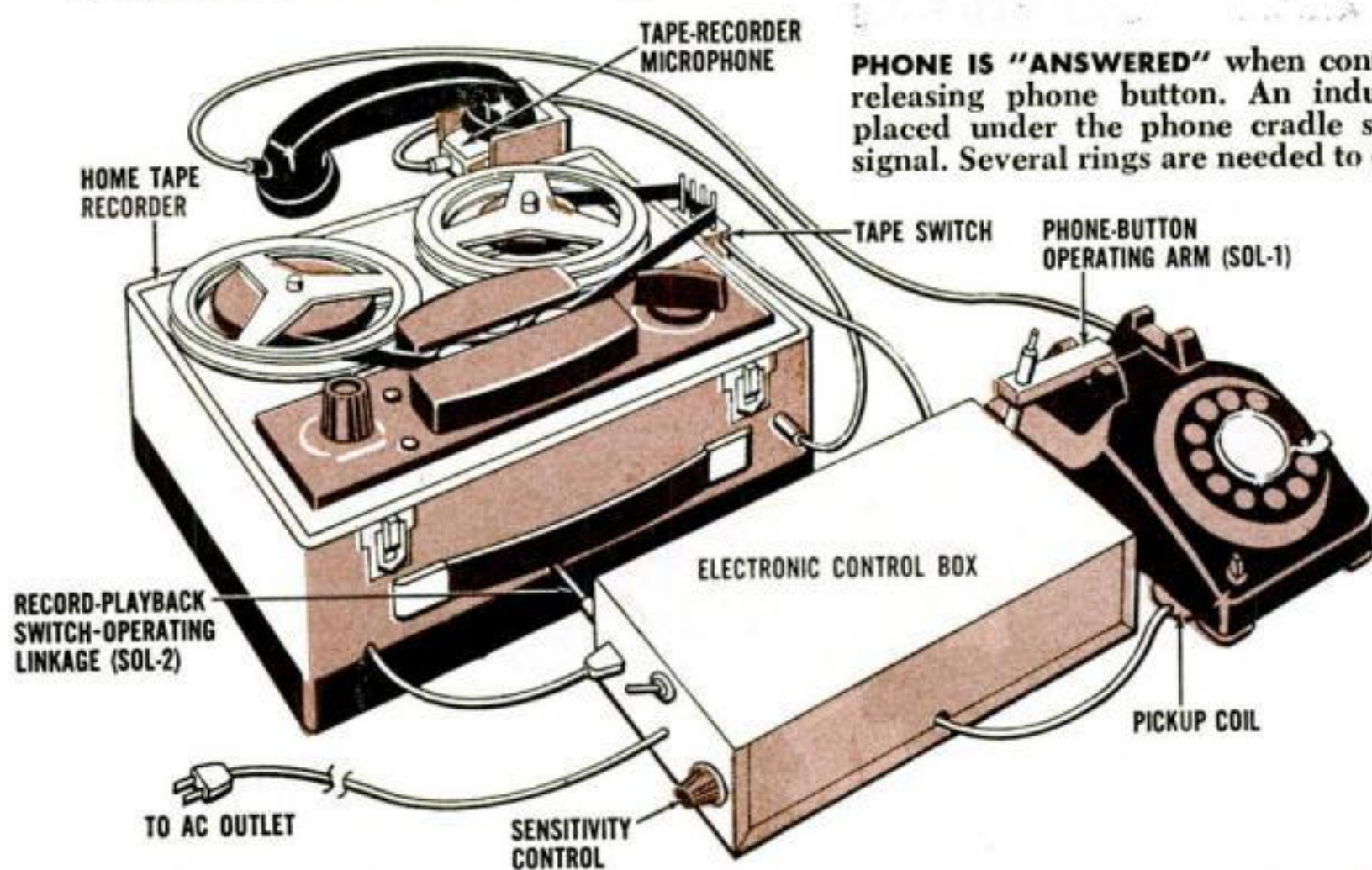
PHONE-BUTTON CONTROL is spring-loaded arm that holds phone button down normally. When phone rings, solenoid plunger raises arm. Set collars provide adjustment for block.



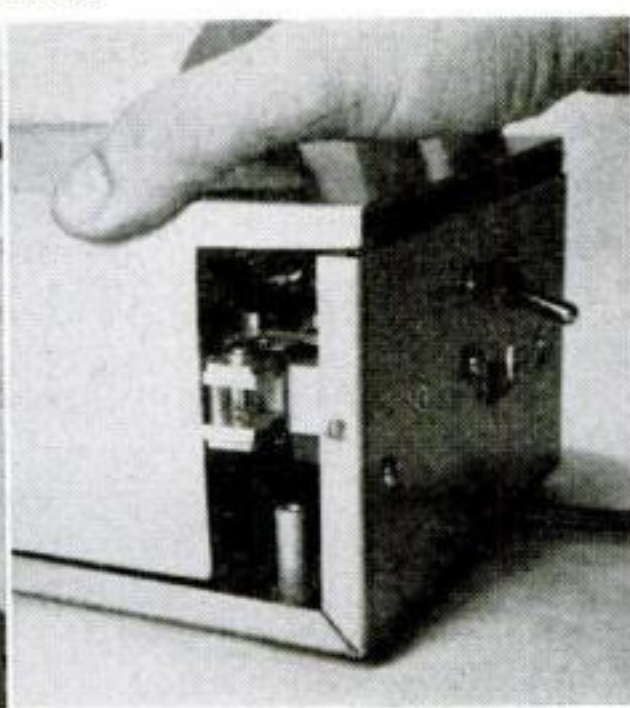
EARPIECE OF PHONE HANDSET rests atop tape-recorder microphone. This feeds phone voice to tape recorder. Mouthpiece of handset hears announcement from recorder loudspeaker.



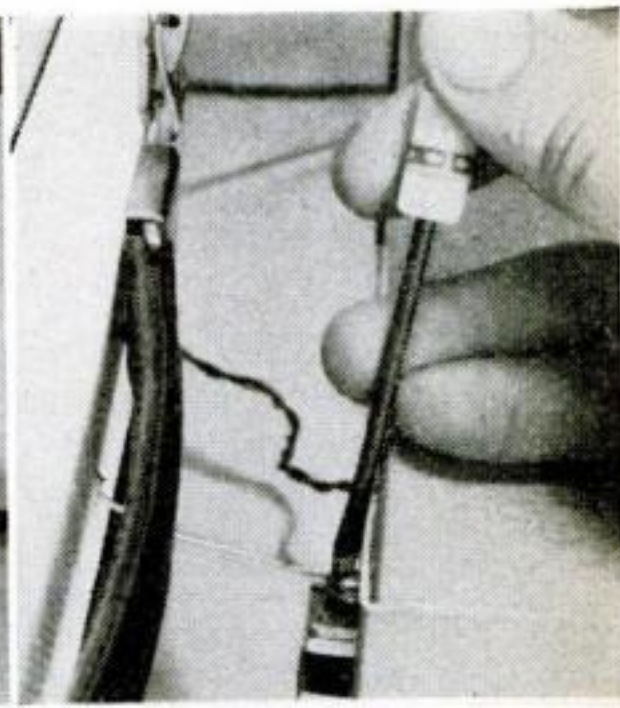
PHONE IS "ANSWERED" when control arm lifts, releasing phone button. An inductive pickup placed under the phone cradle senses ringing signal. Several rings are needed to operate relay.



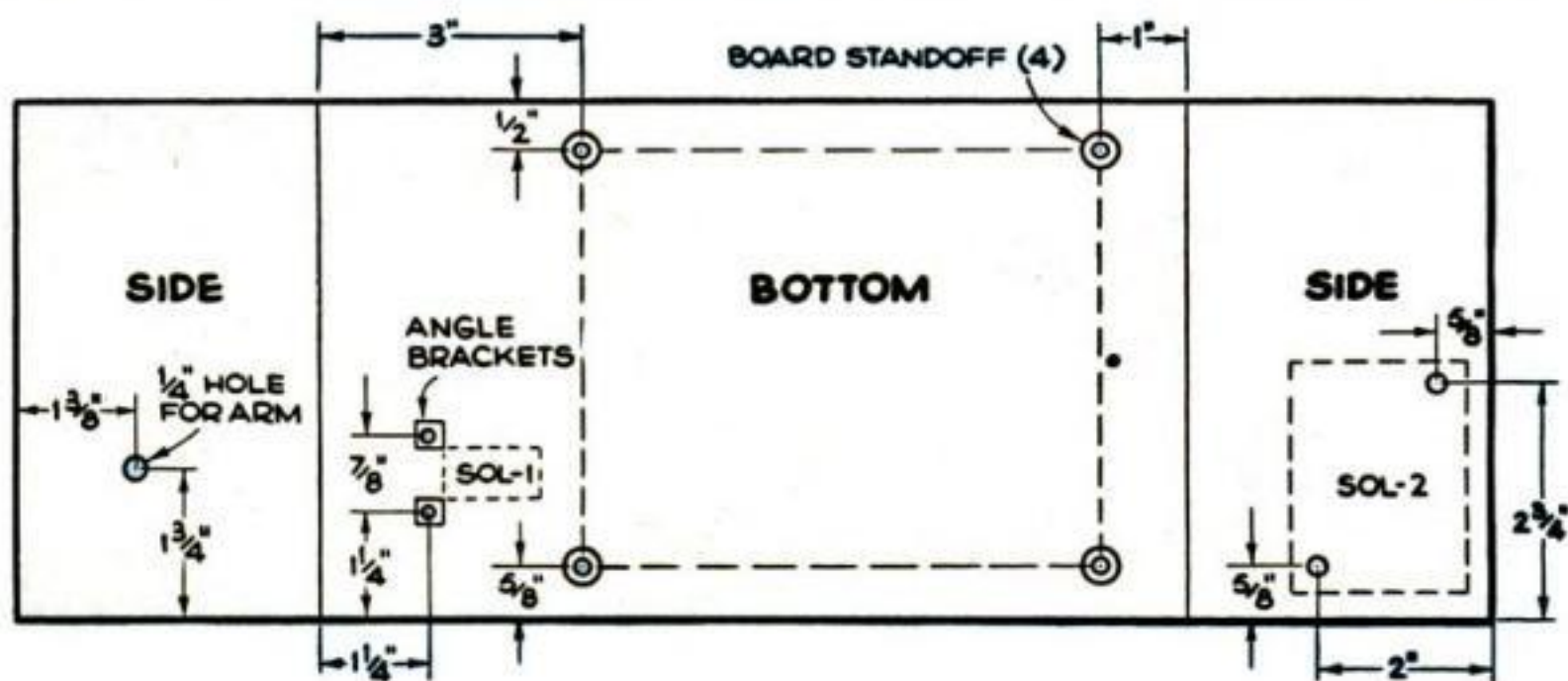
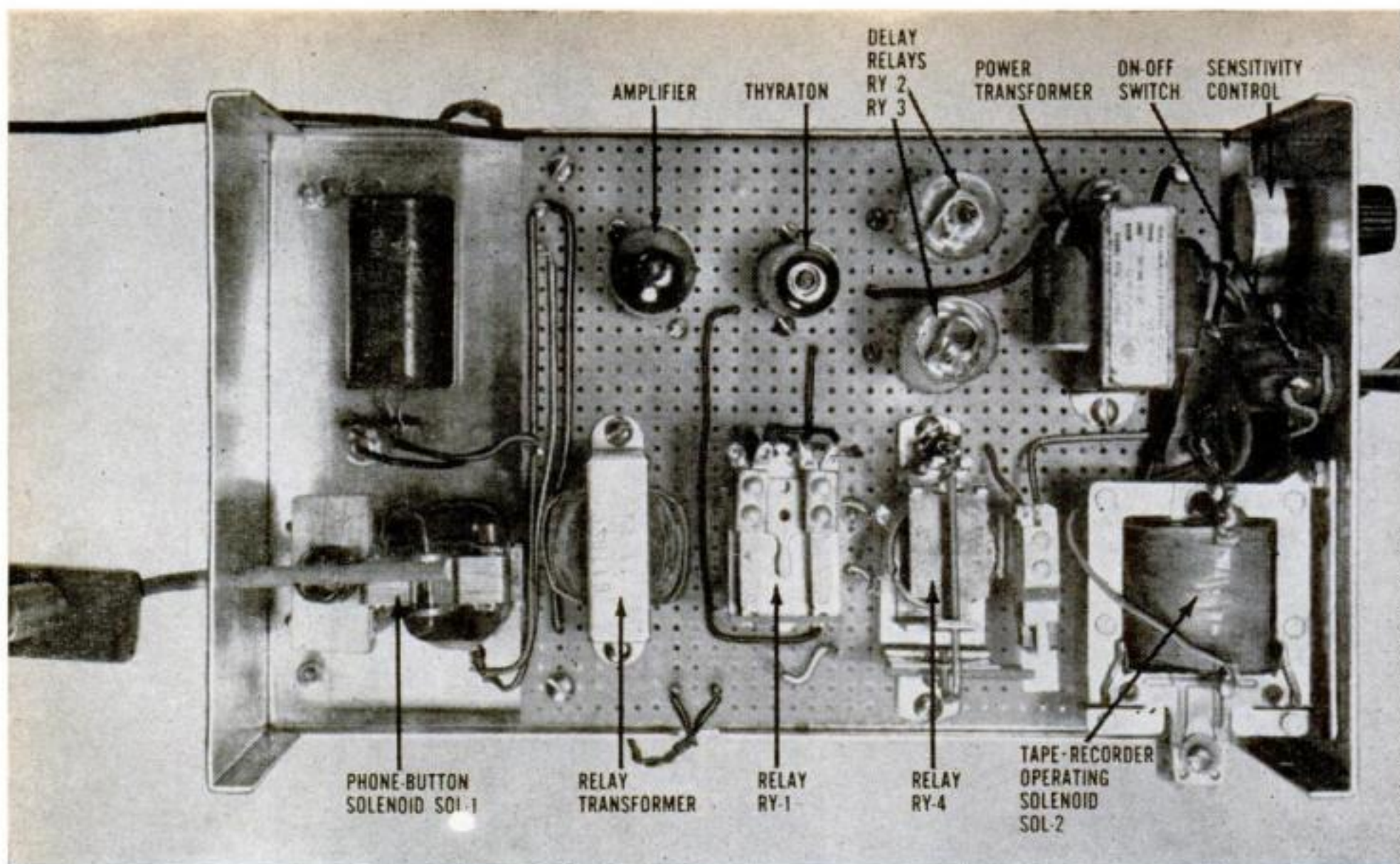
MECHANICAL LINK added to the record-playback switch of the tape recorder allows it to be operated automatically by a solenoid in the control box. Link extends through hole in the recorder case. Side of control box is cut away



(center) for access to solenoid plunger. If box moves when solenoid operates, wedge a wooden block between it and recorder case, below link rod. Check for free operation of hookup after link is fastened.



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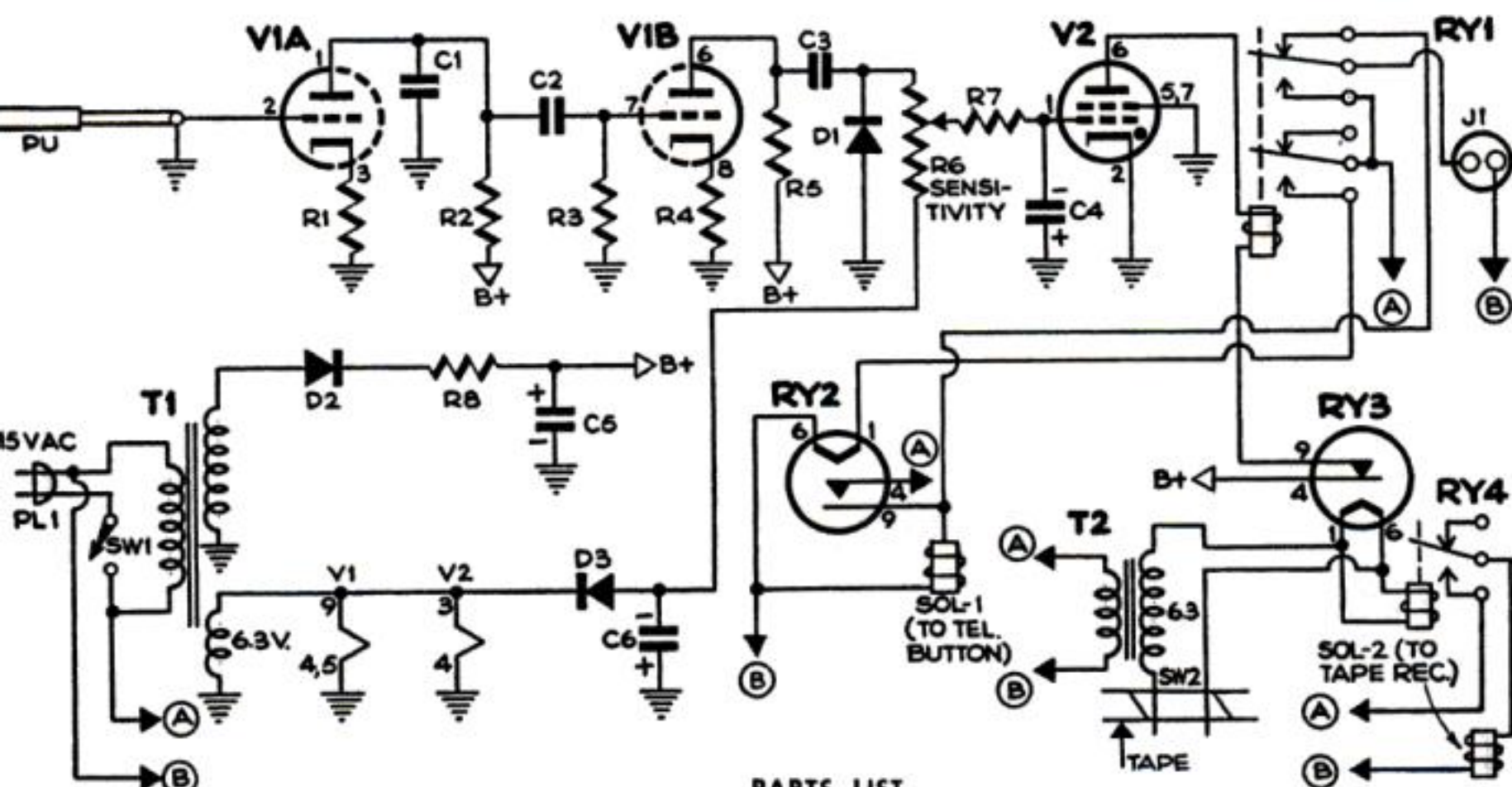
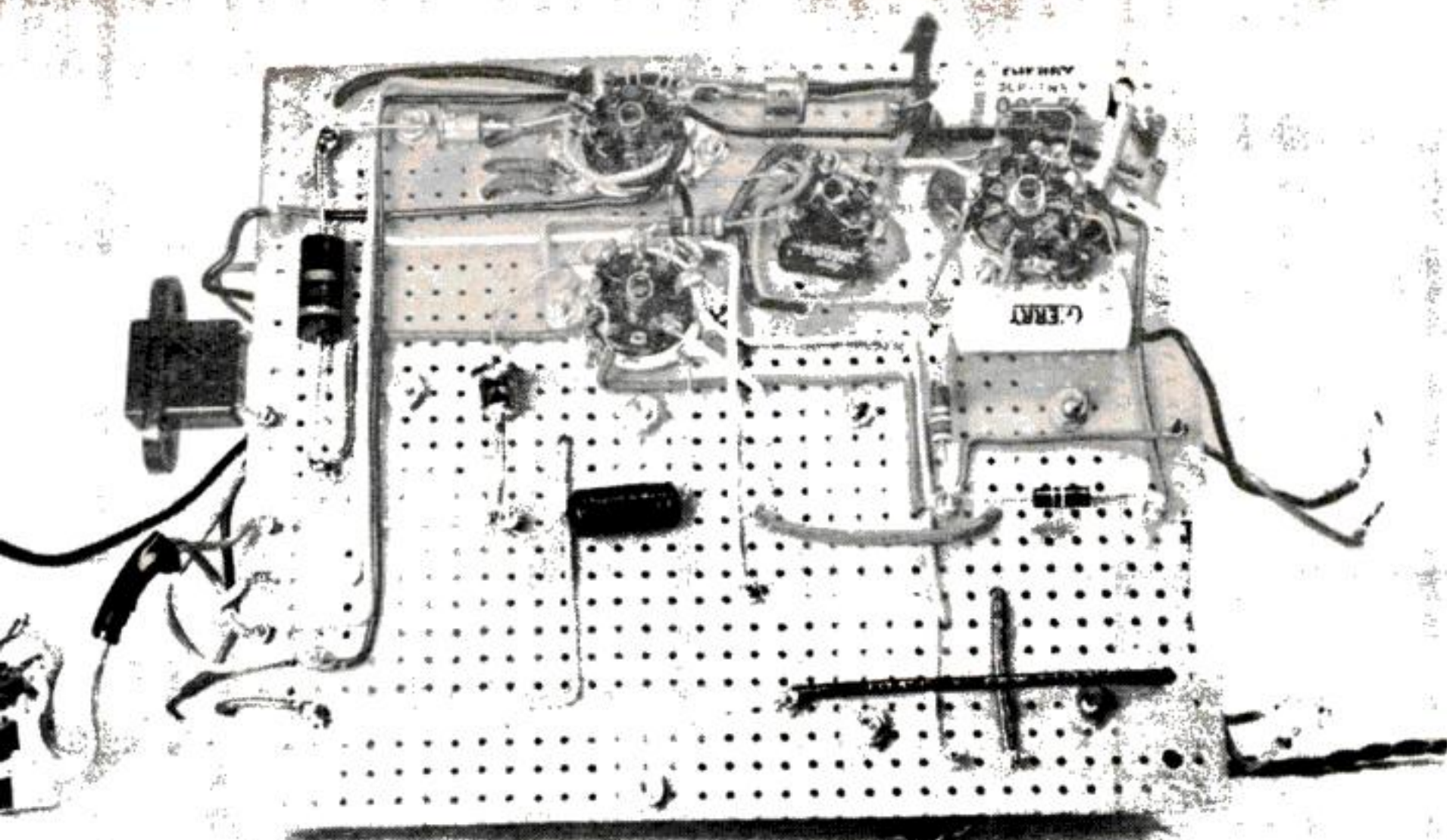
to hold the tape in close contact with the inner ones. A strip of silver paint applied directly on the recording tape completes the circuit between the two contacts. Check the finished switch by threading tape through it and making sure it rides through smoothly.

Your next step is recording a taped greeting. Thread the machine as you would ordinarily except for the tape you lead through the tape switch. Make a "start" mark on the tape next to the switch. In future setups, always begin with the mark in this position. Set the machine to record at $3\frac{3}{4}$ inches a second. Run the tape for 10 seconds and

start the voice announcement. It might be something like this: "Hello, this is a recording. Mr. X is not here. If you wish to leave a message, you may talk for 30 seconds after you hear the click. Thank you. Go ahead, please."

Now you're ready to paint the contact strips. Stop the machine and apply a 1"-long strip of silver paint to the back of the tape at the end of the recorded greeting. Allow the paint to dry. Then run the tape for 30 seconds and apply a 9" strip of silver paint. This completes one message cycle. Make up as many such sections as you're likely to need—you

[Continued on page 224]



PARTS LIST

R1—2,200-ohm, $\frac{1}{2}$ -watt resistor
 R2—470,000-ohm, $\frac{1}{2}$ -watt resistor
 R3—1 megohm, $\frac{1}{2}$ -watt resistor
 R4—1,000-ohm, $\frac{1}{2}$ -watt resistor
 R5—100,000-ohm, $\frac{1}{2}$ -watt resistor
 R6—100,000-ohm, potentiometer (IRC Q11-128)
 R7—47,000-ohm, $\frac{1}{2}$ -watt resistor

R8—2,700-ohm, 2-watt resistor
 C1—.001 mfd. disk capacitor
 C2, C3—.05 mfd. tubular capacitor, 600-volt
 C4—3 mfd. electrolytic capacitor, 15-volt
 C5—20 mfd. electrolytic capacitor, 450-volt
 C6—50 mfd. electrolytic capacitor, 15-volt
 T1—power transformer (Stancor PS-8415)

T2—110-6.3 VAC filament transformer (Lafayette TR-11)
 D1, D2, D3—silicon diode (Lafayette SP-196)
 V1—12AX7 tube
 V2—2D21 tube
 RY1—DPDT relay (Potter & Brumfield GB11D, 5,000-ohm)
 RY2—thermal-delay relay (Amperite 115NO5T)
 RY3—thermal-delay relay (Amperite 6C2T)

RY4—latching relay (Potter & Brumfield PC11A, 6 VAC)
 SOL-1—solenoid (Guardian Type 16, 115 VAC, Cont.)
 SOL-2—solenoid (Guardian Type 18, 115 VAC, Cont.)
 PU—telephone pickup (Lafayette MS-16)
 SW1—SPST toggle switch
 SW2—tape switch (see text)
 J1—AC socket, chassis-mount type
 PL-1—AC line cord and plug

Misc.—Aluminum case, 10"X3 $\frac{1}{2}$ "X6"; four threaded bushings, 1"X $\frac{1}{4}$ " for 6-32 screws (Waldom); large compression spring (from General Cement #H411-F); solder lug; $\frac{1}{4}$ " aluminum rod; two spade lugs; perforated board 6 $\frac{1}{2}$ "X5 $\frac{3}{4}$ "; 2-lug terminal strip; flea clips (Lafayette MS-263); three 9-pin miniature

tube sockets, one 7-pin tube socket (all with center posts); two $\frac{1}{4}$ " to $\frac{1}{2}$ " shaft couplers (for adjusting arm height); silver print point (General Cement No. 21); No. 16 tinned wire, No. 20 hookup wire; four rubber feet; wood strip; piano wire; tape recorder—Lafayette RK 400-WX

Short Cuts for the Machinist

By H. J. Gerber

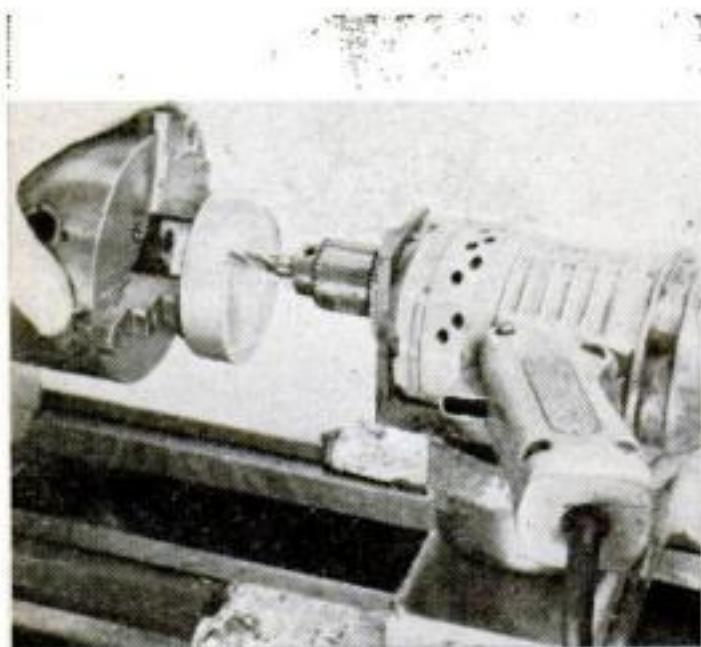
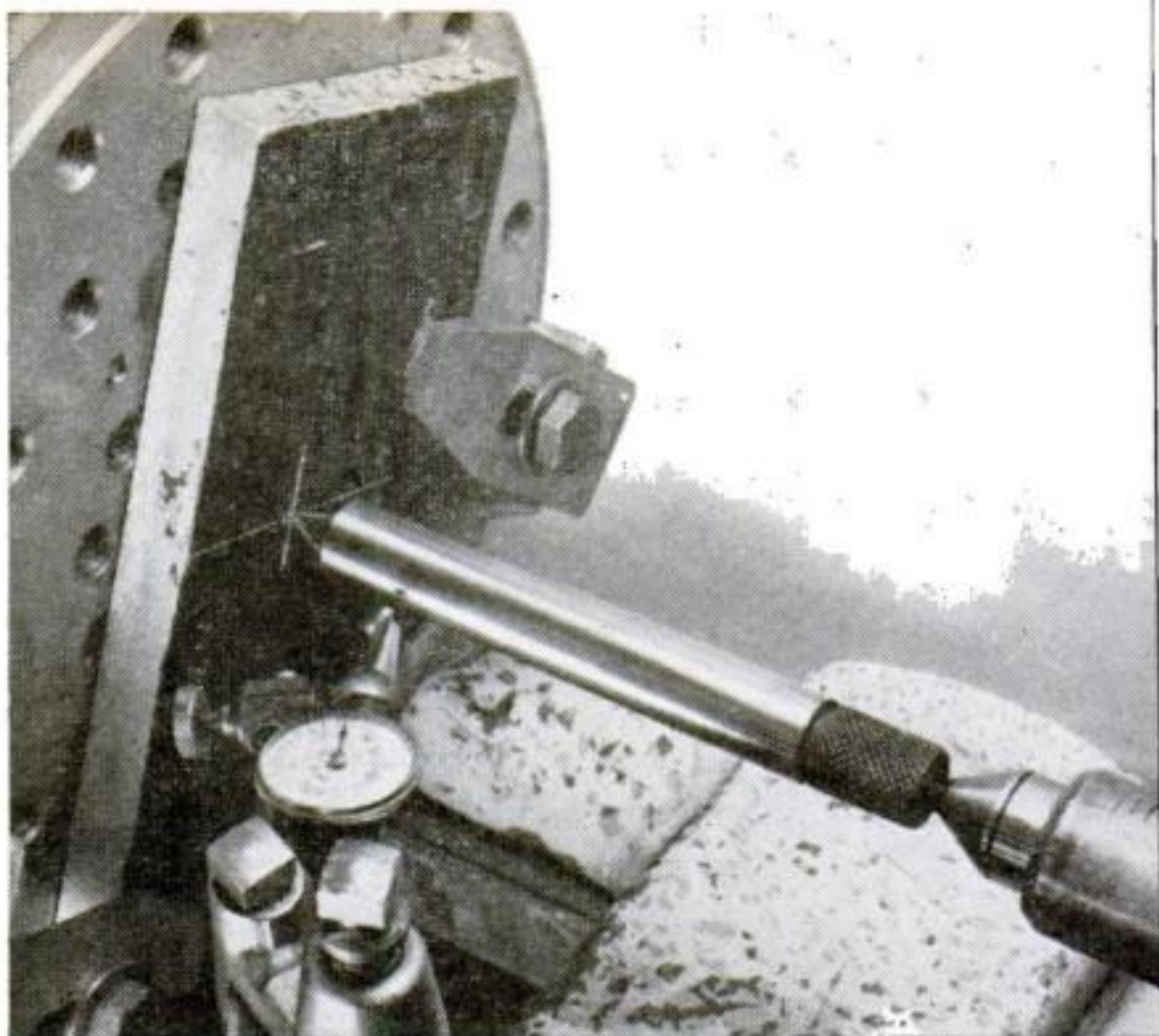
The author is head of the machine-shop department at the Technical Institute of Oklahoma State University's College of Engineering, Stillwater, Okla. He is a long-time contributor to PS.

Pointed test bar can be used with a dial indicator to accurately center work on a faceplate for boring. It was made of tool steel, hardened and ground on centers. The 60-degree point was ground with a tool-post grinder while the shank was gripped in a collet in the head spindle. The point must be concentric with the bar diameter or results will not be accurate.

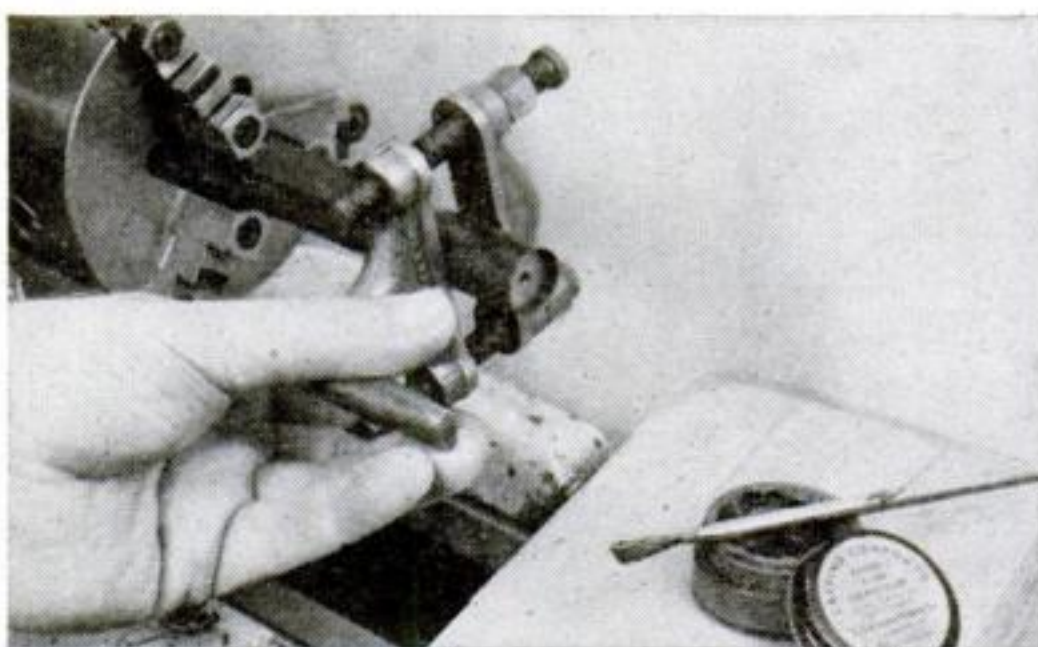
Seat the lathe tailstock center in a center hole in the butt of the bar, the bar point in a center-punch mark previously laid out at the desired location for the hole. Place the dial indicator in the tool

post and bring it in contact with the bar as near as possible to the point.

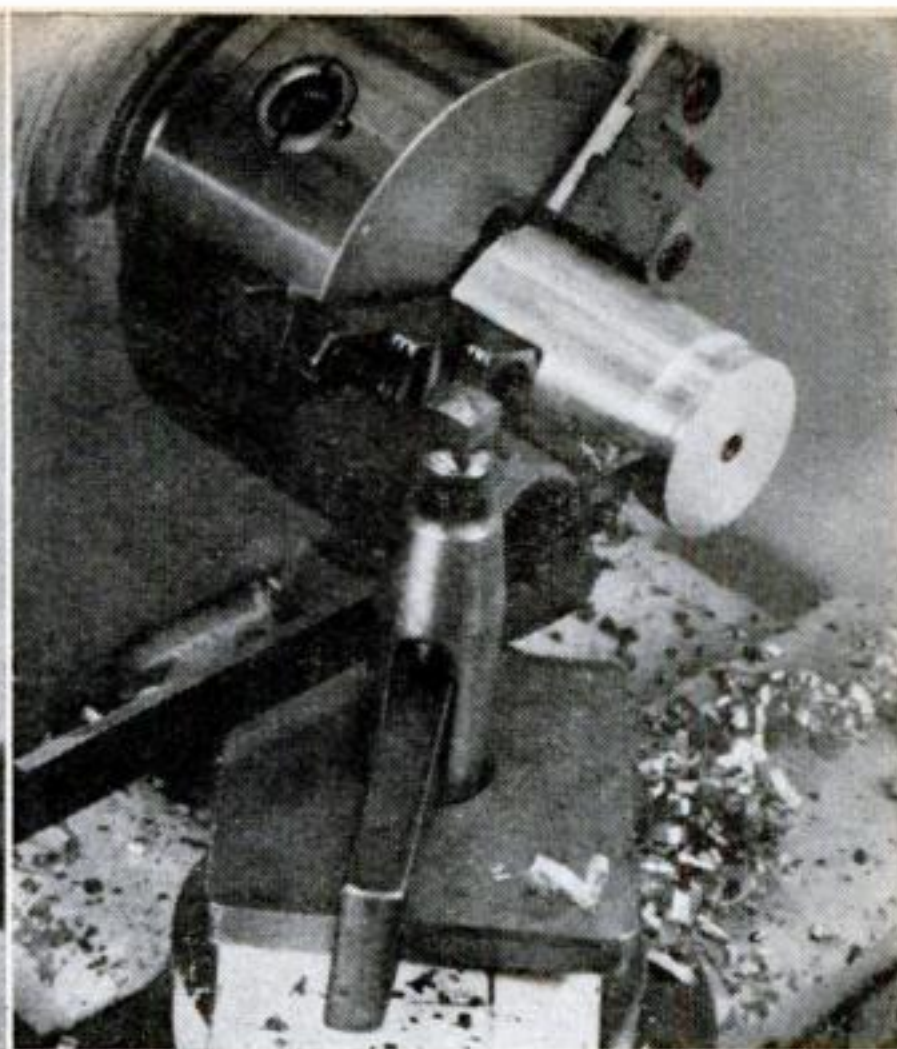
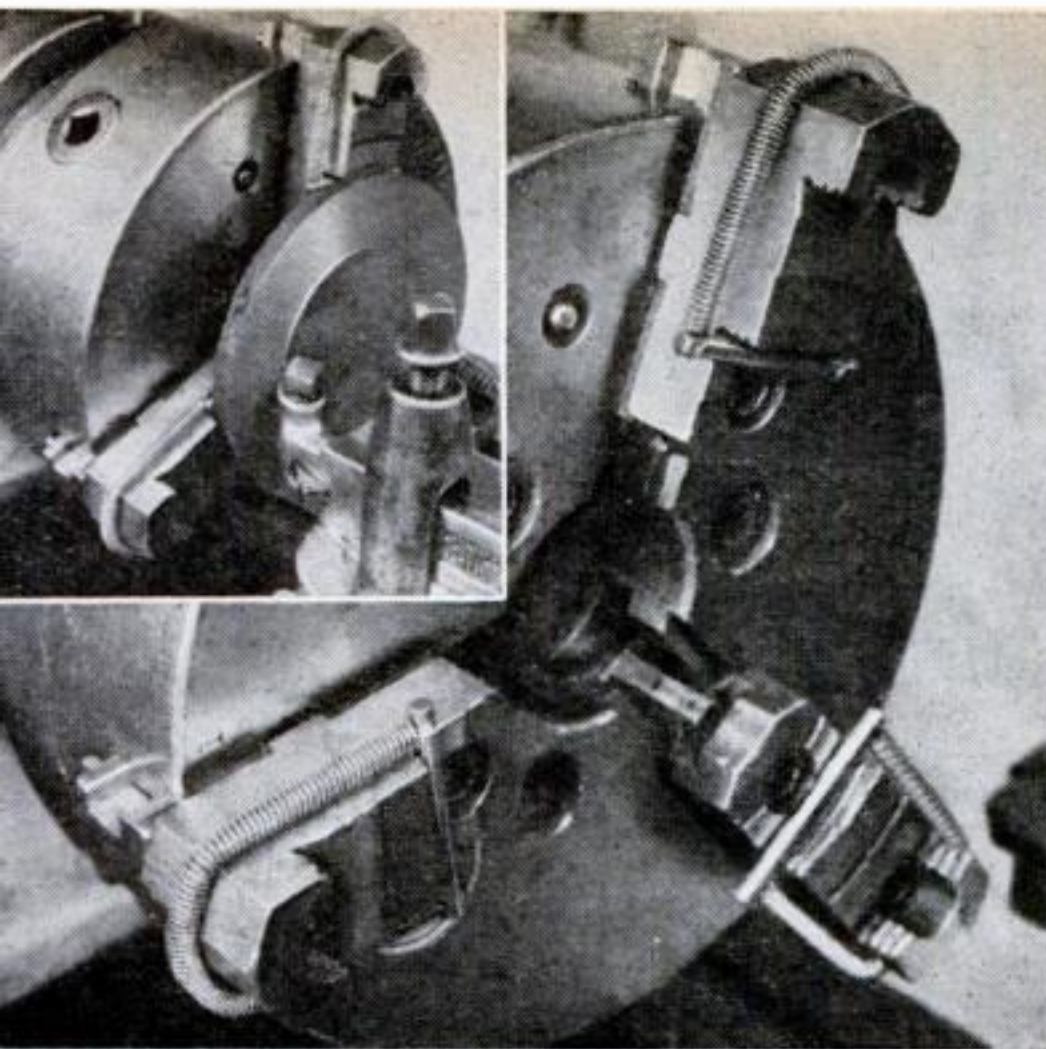
Now rotate the faceplate by hand. This will cause the bar to wobble if it is not dead true and the indicator will detect the runout. Tap the work one way or another with a soft hammer. When a complete rotation no longer produces any needle movement, the center-punch mark is running on true center.



A portable drill can be a lifesaver for jobs such as this slotting operation. The drill is secured to an angle bracket fastened, in turn, to the compound of the lathe. The setup was devised to machine a semicircular slot part way around the face of the aluminum casting that's shown above in the lathe chuck.



Cylindrical lap can be improvised from split tubing and a clamp-type lathe dog. Use a hacksaw to split thin-wall copper or brass tubing. The dog serves as a handle for traversing the lap (moving it sideways) and for adjusting the tightness of the sleeve on the work. For fine finishes, apply only a small amount of compound. A light oil or mixture of soluble oil and water, used as a lubricant, will usually improve the finish that you'll be able to produce.



Chuck thin disks in a lathe is a problem. It usually requires some sort of spacer so the work will protrude beyond the outer faces of the jaws.

Here's a fine way to do it—spring-retained pins. The pins must be long enough to stick beyond the rim of the work and provide space for the spring loops. Pieces of soft-steel bar can be used instead of pins if you wish.

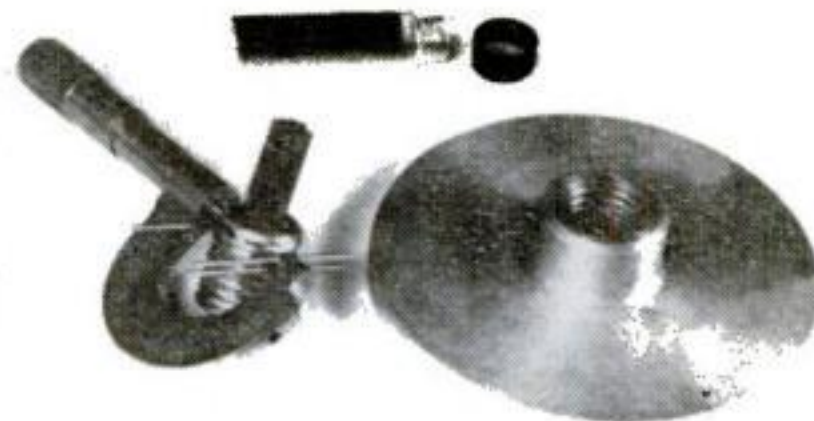
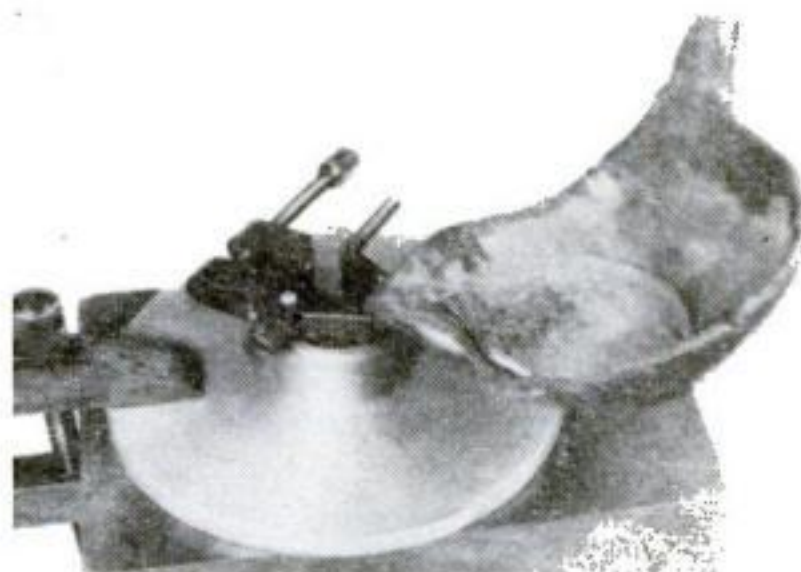
Measure internal threads by using a low-temperature bismuth alloy to make a proof casting if you can't get at them for a direct measurement.

A number of such products are now on the market. They melt at temperatures lower than that of boiling water and will not damage any work into which they are poured. I usually use the one called "Cerro-safe." It pours at 190 degrees. It shrinks slightly right after solidifying but regains true size later. The maker claims shrinkage is only four tenths of a thousandth per inch and says the size return is to exactly zero error within one hour. This temporary shrinkage permits easy removal of the proof. A light oil applied to the threads will aid clean parting.

When the proof has been removed, it's easy to make a precise measurement by use of the three-wire system and a micrometer (lower right). The alloy was poured around an iron-bar handle.

A solid support under a cut-off tool in place of the usual ring and rocker will improve its performance. Drill a hole in a flat plate so it can slip freely over the tool post.

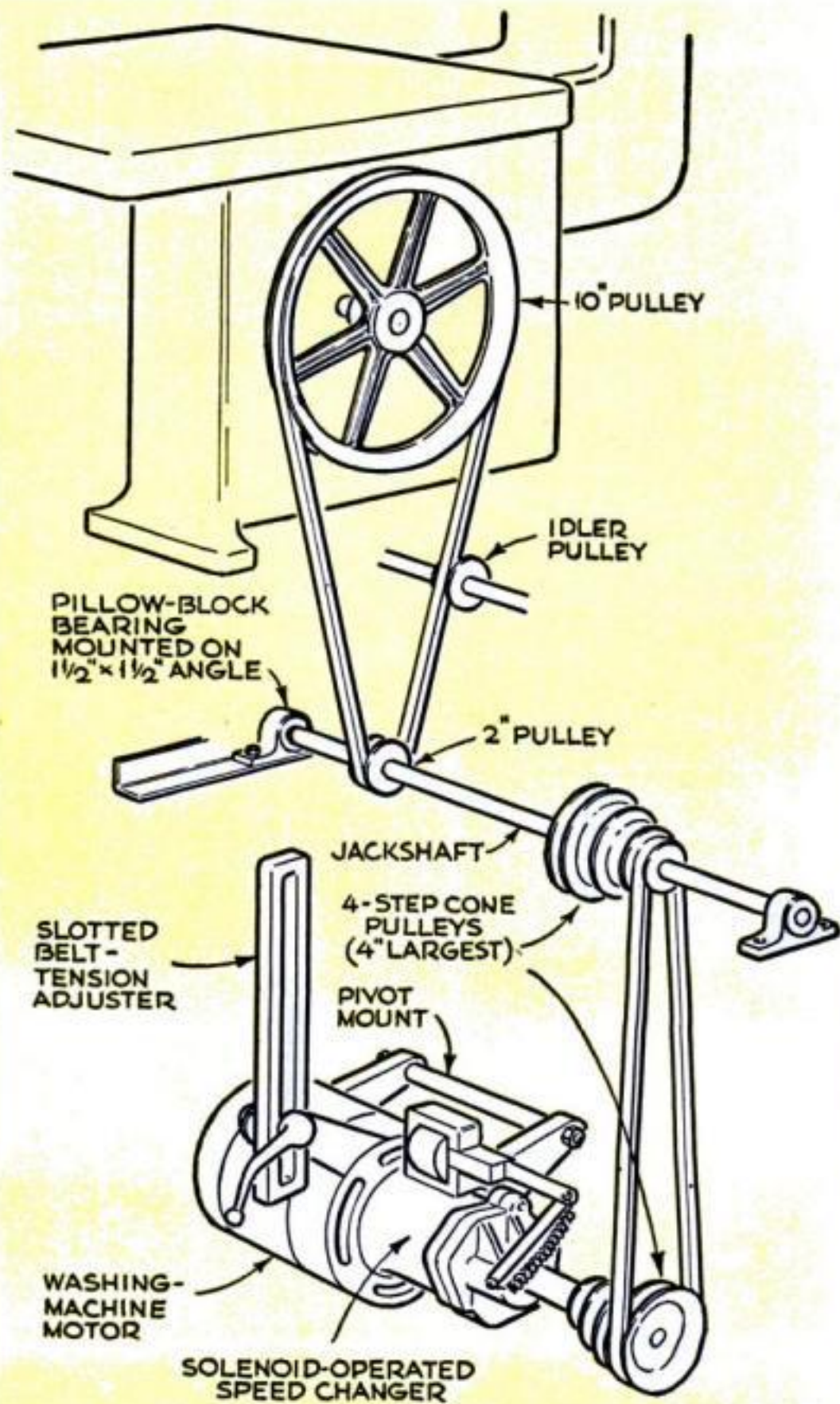
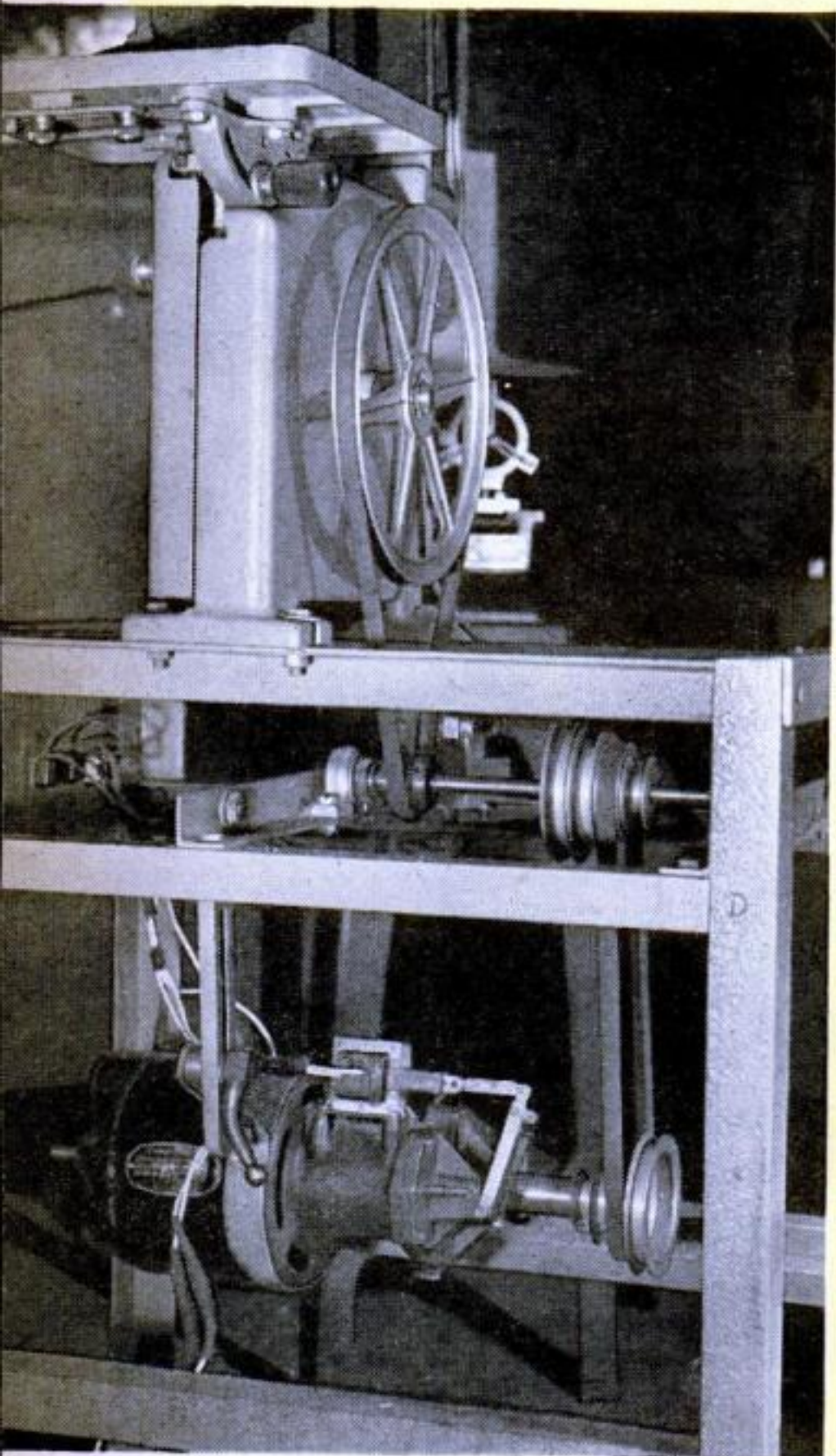
The plate should be just thick enough to position the cutting tool on exact center with the lathe axis. The plate cuts vibration and keeps the tool from slipping down and hogging into the work.





**How I adapted the
power unit of a
washing machine as—**

A Speed Changer for My Bandsaw



I CHANGE speeds on my bandsaw by merely flipping a switch. This lets me shift quickly from wood to metal cutting without even shutting the machine down.

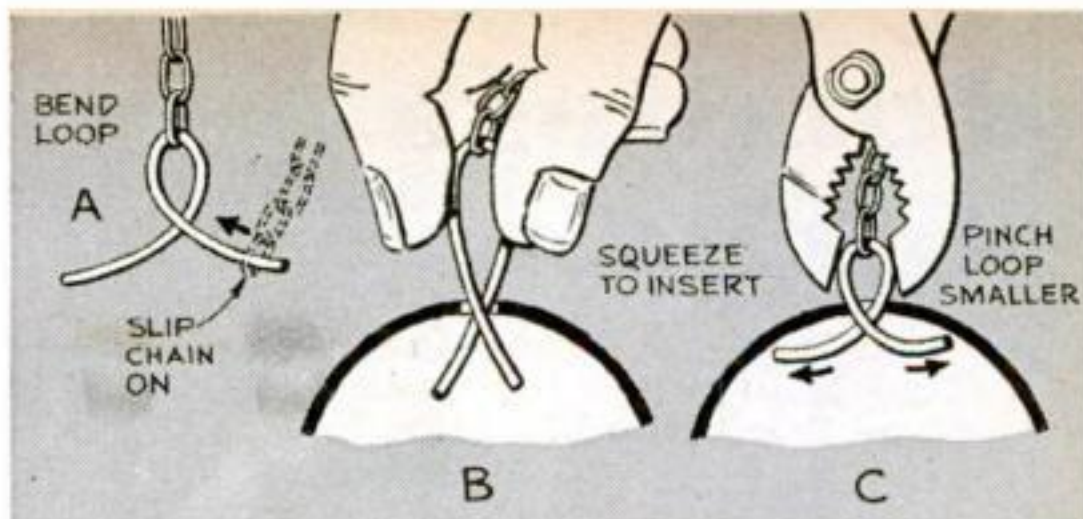
Any bandsaw can be rigged in the same way if you use a motor salvaged from an old spin-type washing machine. These motors have a wonderful solenoid-operated two-speed clutch built right into them. You simply mount the entire unit, as is, in place of the bandsaw's regular motor.

By wiring the solenoid to a toggle switch, you can shift from low speed (originally the motor's washing cycle) to high speed (the spin-dry cycle). With the switch in the off position, the spring-loaded clutch mechanism automatically returns to low speed. A second switch turns the motor itself on or off, so I have complete control at my fingertips.

For two-speed operation, that's all you need. The added jackshaft shown here, along with the two four-step cone pulleys, multiplies your speed choices to eight, with each of four pairs controlled by the switch. Lowest possible speed with this setup is a real crawler—only 10 r.p.m.

The motor is mounted on a pivoted bracket so its weight does the belt-tightening. However, since the full weight would be too much, I added a clamp screw sliding in a slotted arm to help adjust the motor's tension. The idler pulley in the final stage improves belt contact and lessens wear, as the constant speed-changing can be a bit rough on the belt.

A few washing-machine motors have three speeds and two solenoids, but these can be used in the same way by adding a switch to control the second solenoid.—*Henry Frostick, Farmingdale, N. J.*



Flush-Tank Valve Made from a Ball

AN EMERGENCY replacement for a flush valve can be made of a smooth, hollow rubber ball about 2½" in diameter and a 3" length of bicycle spoke or similar hard wire, bent to form a loop (A).

Slip on the chain and insert the ends of the wire in a hole punched in the ball (B). When you pinch the loop smaller, the legs spread and lock upward inside the ball, as at C.

The valve will serve until the steel wire rusts through.—*Harry Walton, White Plains, N. Y.*



Heart-Shaped Cookie Cutter

THE household cooky maker will like this idea for St. Valentine's Day. Remove the top and bottom from a shallow can and you can easily form it into a heart-shaped cutter, as shown above. Make cutters in several sizes.—*Harry Wheeler, Toledo, Ohio.*



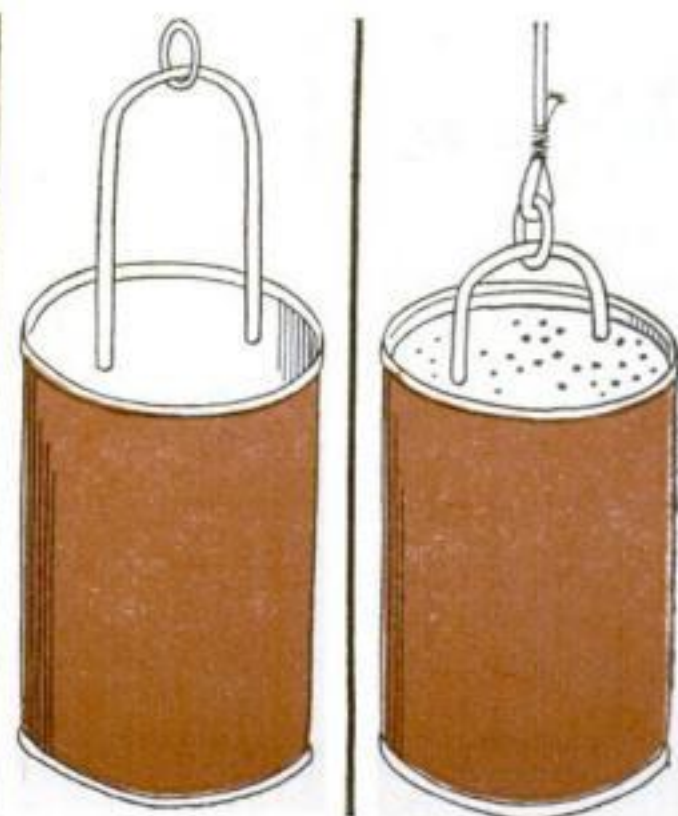
Marking Studs for Nailing Wallboard

SHORT pieces of masking tape can be used to mark stud locations when you erect wallboard partitions on a tiled floor. The tape won't rub off (as chalk or crayon do), yet can be easily removed when the job is finished.—*Ernest E. Hickman, Farmington, Mich.*

▶▶▶ WHEN water pipes freeze in the wall, a vacuum cleaner can be used to force air along the pipe between the studs and melt the ice. Hang the cleaner from the basement ceiling and warm air from the furnace will speed up the process. There is usually enough space near the pipes so that some arrangement can be made to get the air going from the bottom up.—*Ingvald M. Thvedt, Faribault, Minn.*

Wordless Workshop

By Roy Doty
and Eric A. Karminski Jr.



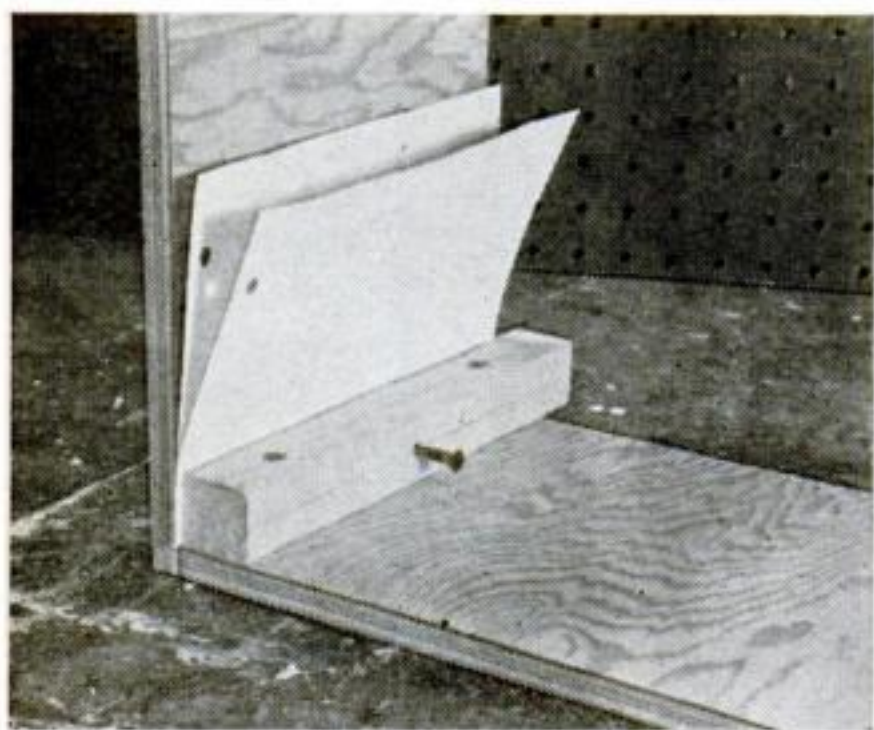


Short Cuts and Tips

FROM PS READERS

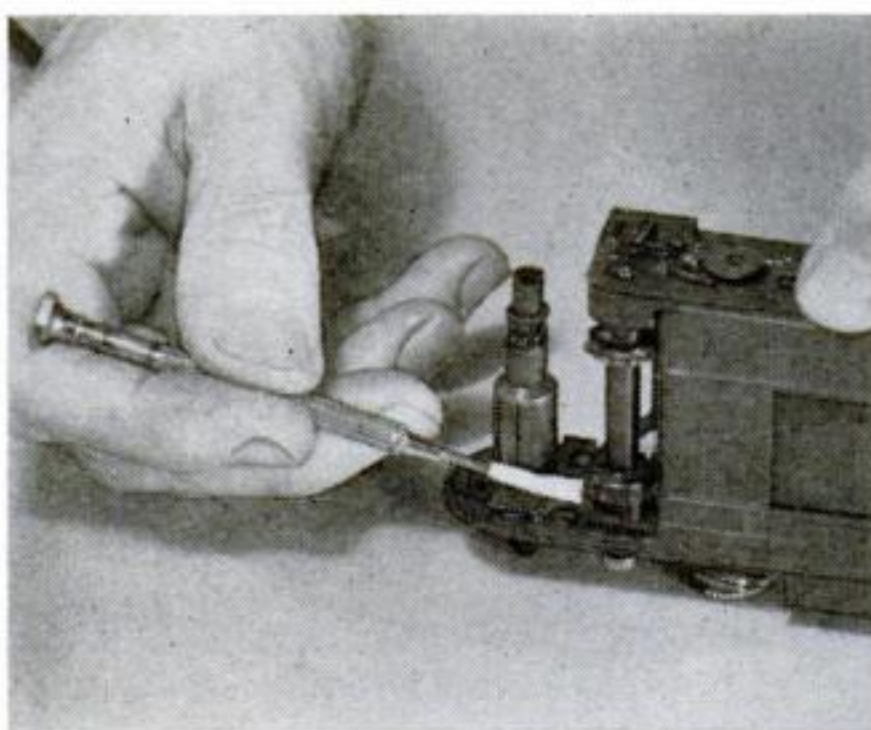
Outlet for a Bookcase Headboard

TO ELIMINATE the tangle of wires from our bed lamps and clock radio, I put an outlet box at the back of the headboard shelf. Since cords no longer had to trail down to a baseboard plug, I shortened them.—*Jack Kenison, Tacoma, Wash.*



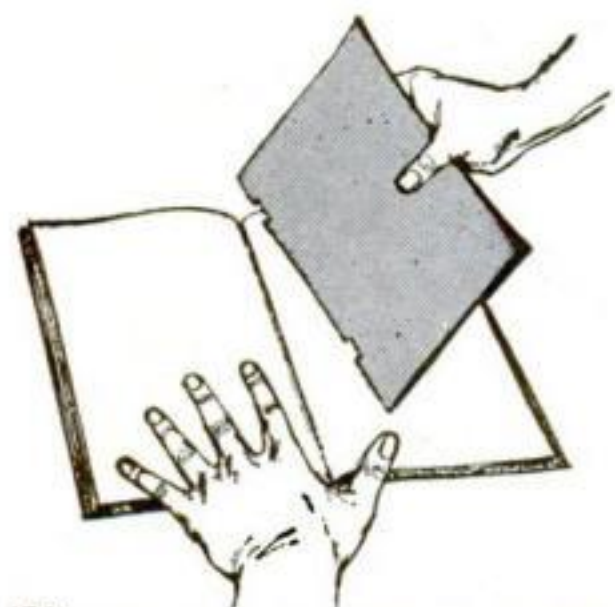
Drawing Butt Joints Tight

YOU can draw a block-reinforced butt joint up tighter if you insert a folded sheet of paper between the block and one side of the joint. After you've driven screws into the bottom member, as shown, tug the paper free and tighten the second side, closing the gap.—*R. J. De Cristoforo, Los Altos Hills, Calif.*



Cleaning with an Adhesive Swab

DRY-CLEAN delicate machinery by wrapping pressure-sensitive tape around an awl or a jeweler's screwdriver blade. The tape picks up any loose grit it touches, and is easily renewed. Attach a 1½" piece with one turn before folding it back on itself, putting the sticky side out.—*Walter E. Burton, Akron, Ohio.*



To remove this SAVE-IT SECTION...

... Pinch the eight pages together (including the two-page Nailing Know-How File) and lift firmly. This will tear all the pages free from one staple and then the other. When the section is loose, staple it along the back fold and crease a strip of tape over the spots torn out by the staples.

Keep it with the Save-It Sections previously published—on making tables and chairs.

The Fine Points of Chair Making

PART TWO

By **R. J. De Cristoforo**

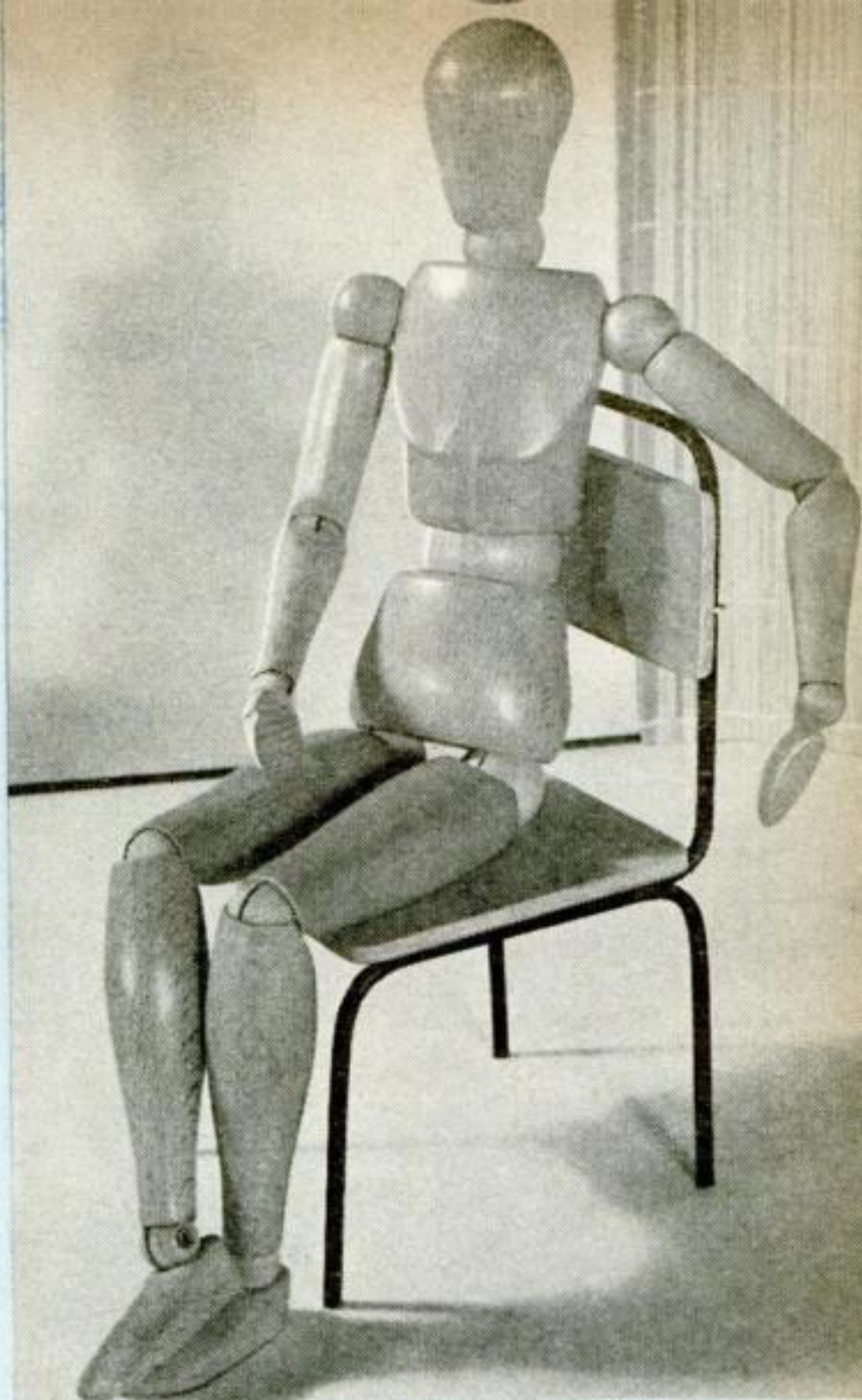
A CHAIR with a tubular frame is often easier to build than one made of wood. Bend a piece of tubing into a U and you have two legs plus a seat support; or, if the bends are opposed, you have a leg, a seat support, and a vertical for the back. Two such pieces plus one U shape, tied together with a padded seat and back, give you a complete chair.

You can use tubing such as do-it-yourself aluminum and electrical conduit, perhaps painted black to resemble wrought iron. Some metal-to-metal joints can be welded. Or you can use nuts and bolts. Mechanical fasteners usually can be hidden effectively.

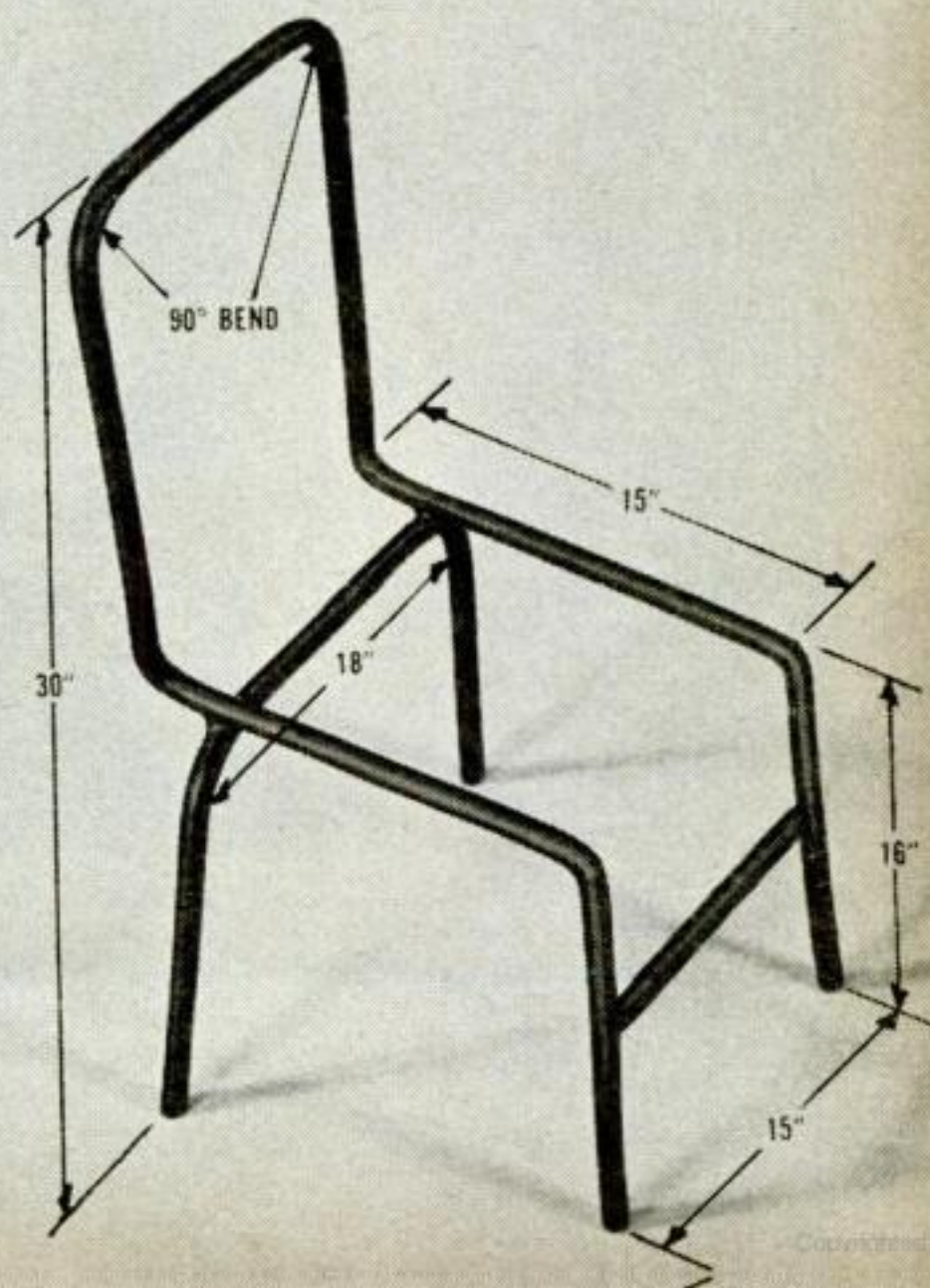
Most bends can be fairly generous; this makes the job easier. The best bet is to use oversize lengths and trim to size after the bends are made. For conduit, you can use an ordinary tube bender; it costs about eight dollars, or you can rent one. It's okay if the tube flattens a little in the

CLEAN LINES of a tubular frame come from using only a few pieces, three here. All bends for the chair are 85 degrees, except the two indicated as 90. This gives a desirable 5-degree slant from vertical to legs and back. Rear legs also are welded on at a 5-degree slant.

CONTINUED

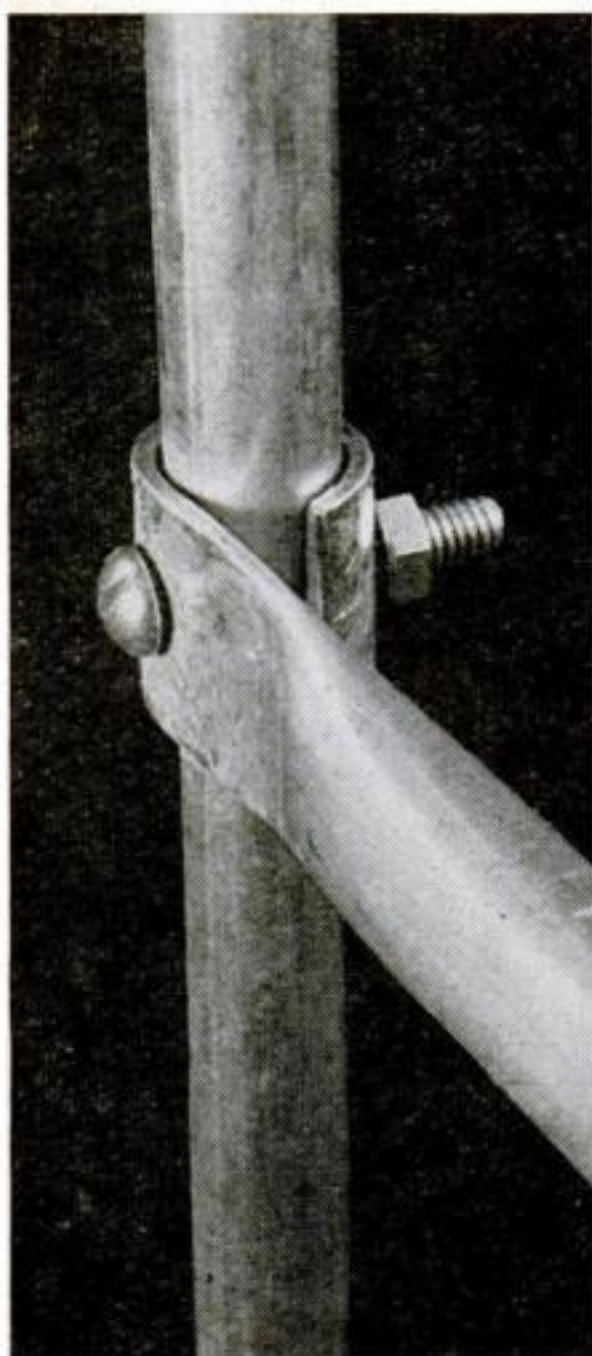
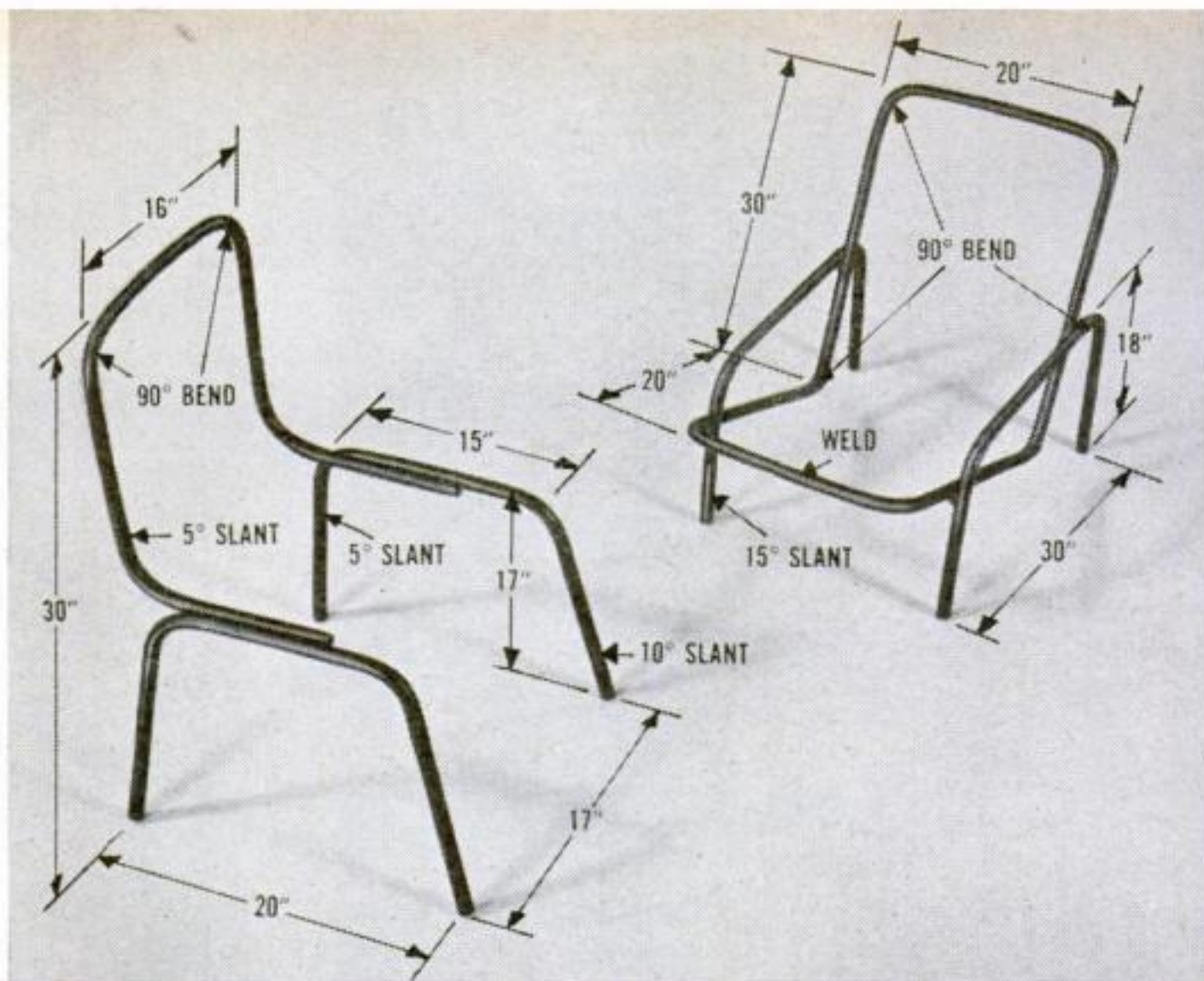


TUBULAR FRAMES are ideal for home-shop construction if you stick to simple designs.

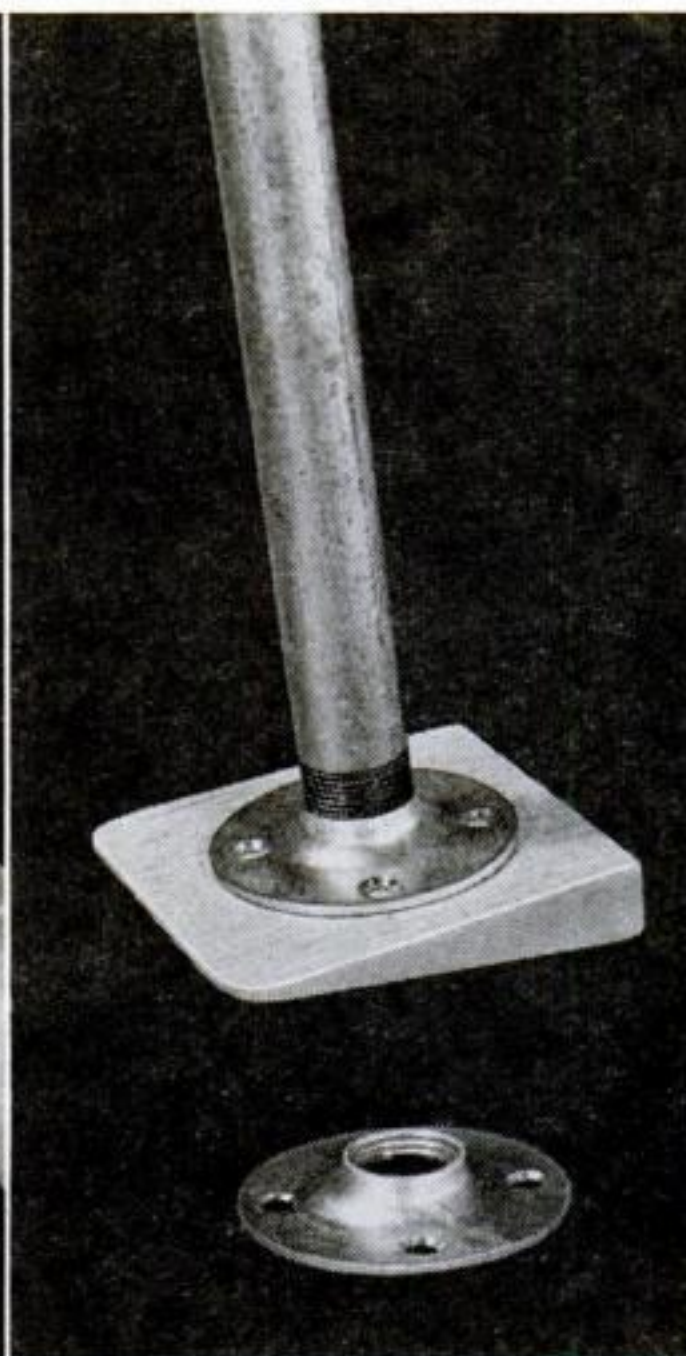


Tips on working with tubing

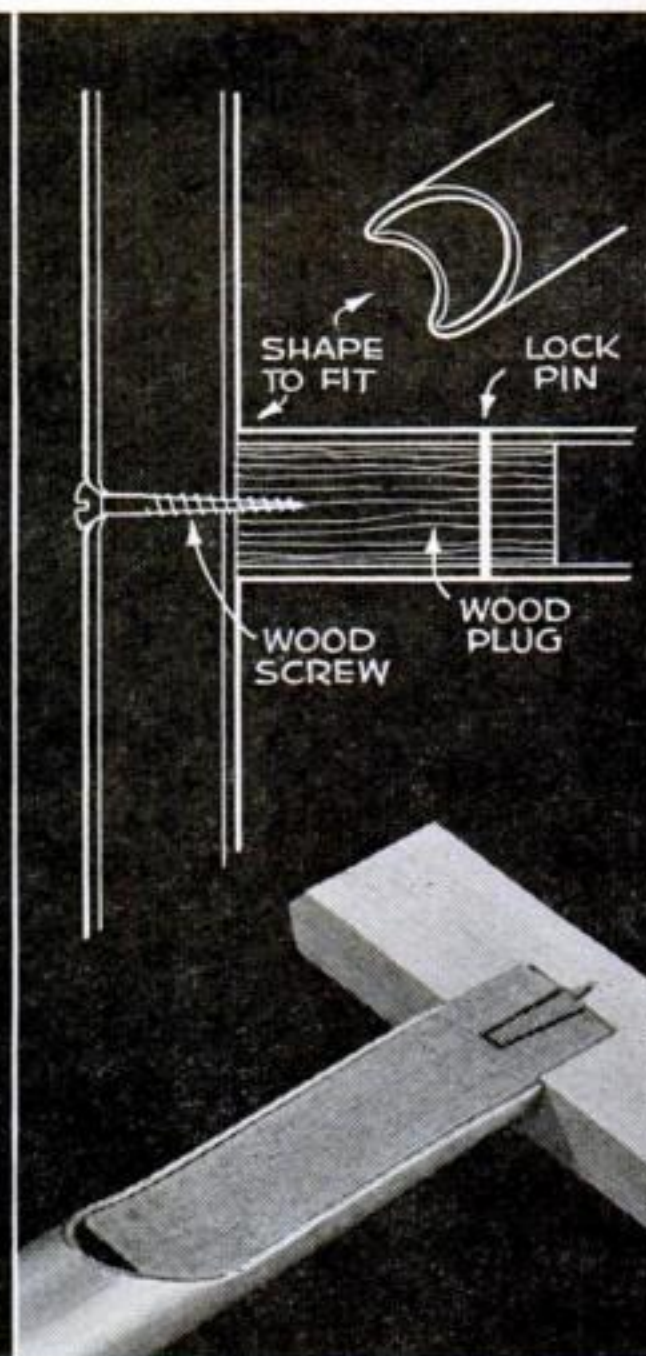
THREE PIECES of tubing were used for each of these frames. The lounge chair at the right is a continuous loop with the ends joined by a weld or sleeve at the front edge. The seat for chair at left should be about 17" front to back and wide enough to overhang sides.



SOFT TUBING can be flattened at the end and shaped into a joint as above. Squeeze it in jaws of a vise first. Complete job with a mallet as tubing rests on metal surface.



LEGS can be made from galvanized pipe and flanges. In some cases you'll find that stock lengths will serve. A wedge block gives a slant to legs, either in one plane or two.



WOOD PLUGS can be used to join tubing to tubing (top) or tubing to wood (below). Plug must be tight, or you can use a lock pin. Lock wedge can be exposed—or hidden, as here.

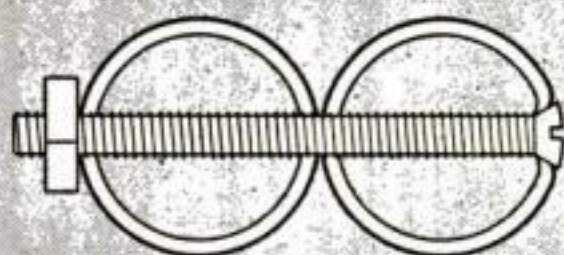
Fittings that make the job easier



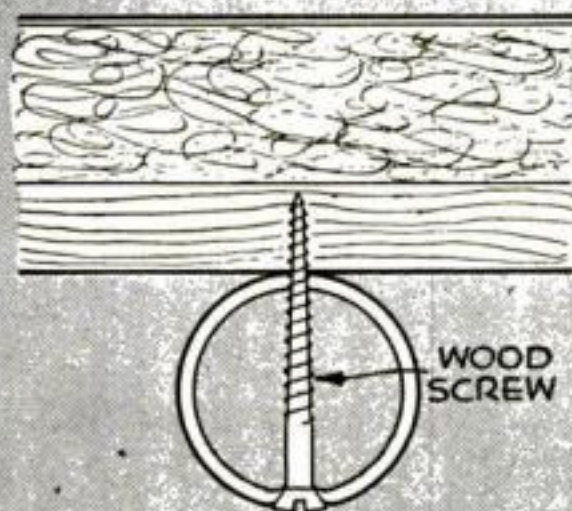
YOU CAN BUY FITTINGS like these. Directly above are examples of items available for copper pipe or tubing. Such joints are sweat-soldered. This tubing can be polished and



lacquered, or painted black to resemble wrought iron. Above are examples of fittings for do-it-yourself aluminum. Tubing has been cut away to show how fasteners work.

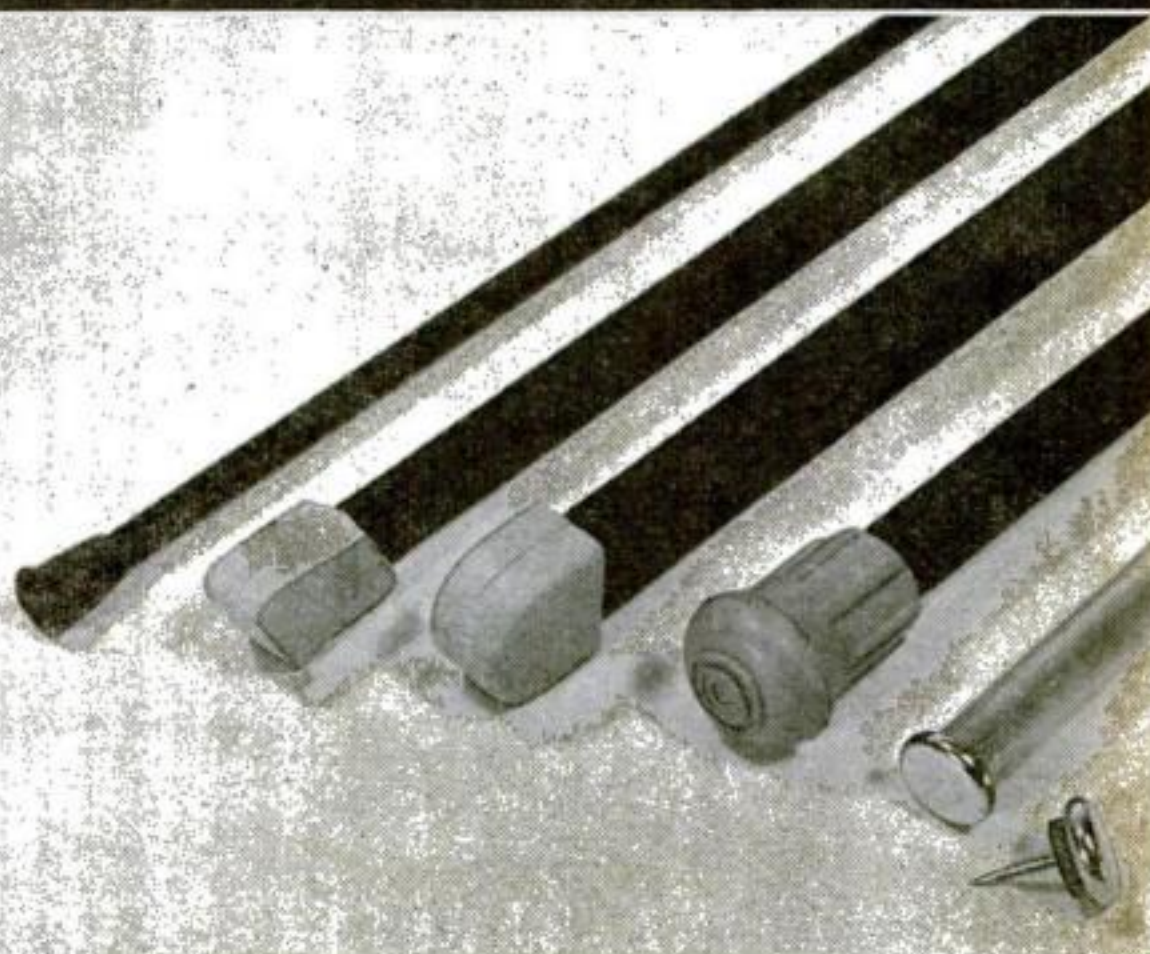


ATTACHING SEAT
BACK AND PAD



SEAT OR BACK PAD can be fastened to tubing by running wood screws through holes drilled in tubing. Screwhead forms own countersink. Bolt can be used to join tubing, as at top.

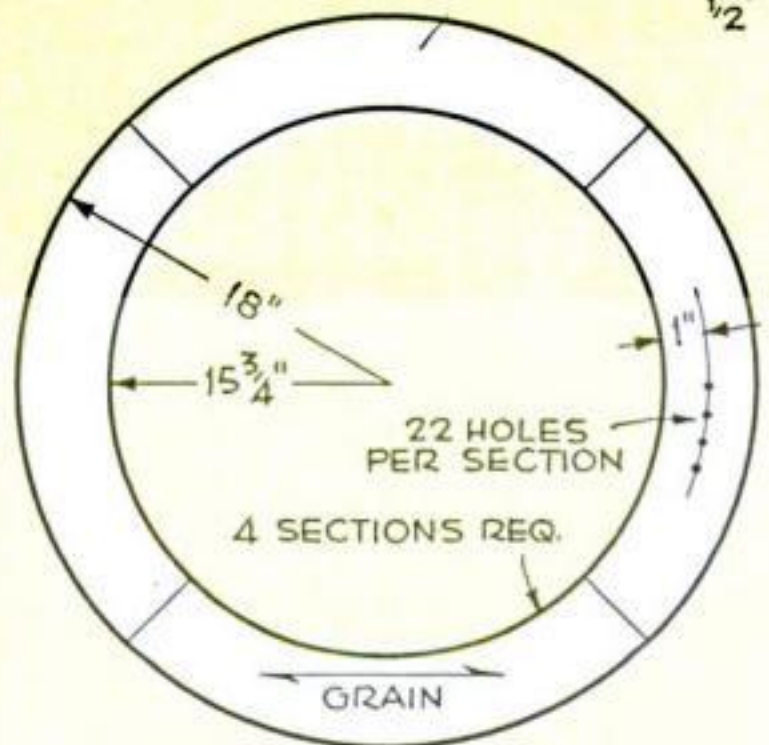
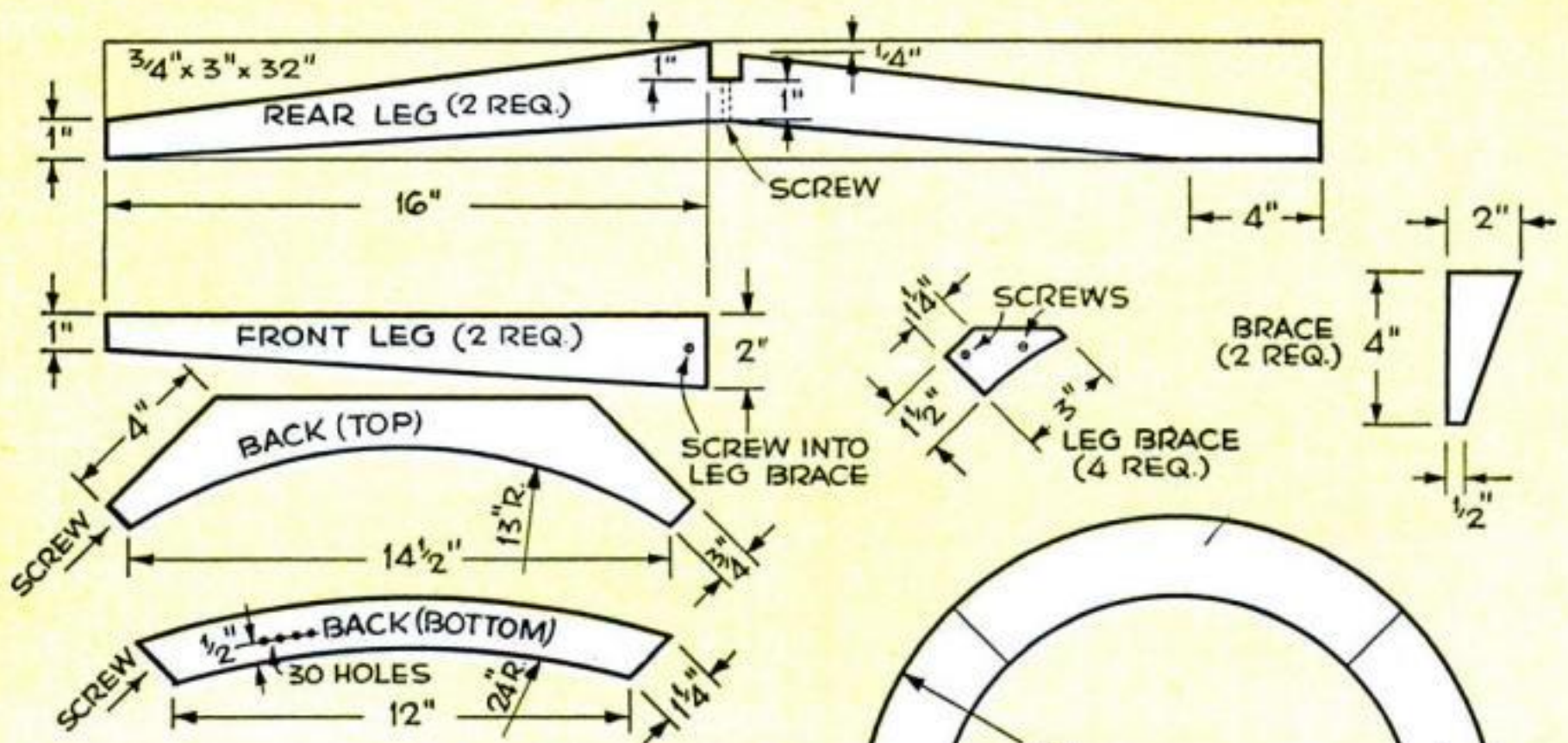
WOODEN ARMRESTS can be provided as shown at right. A V cut in the wood is easiest, or you can make a cove shape with a router or circular saw. The fasteners are simple wood screws.



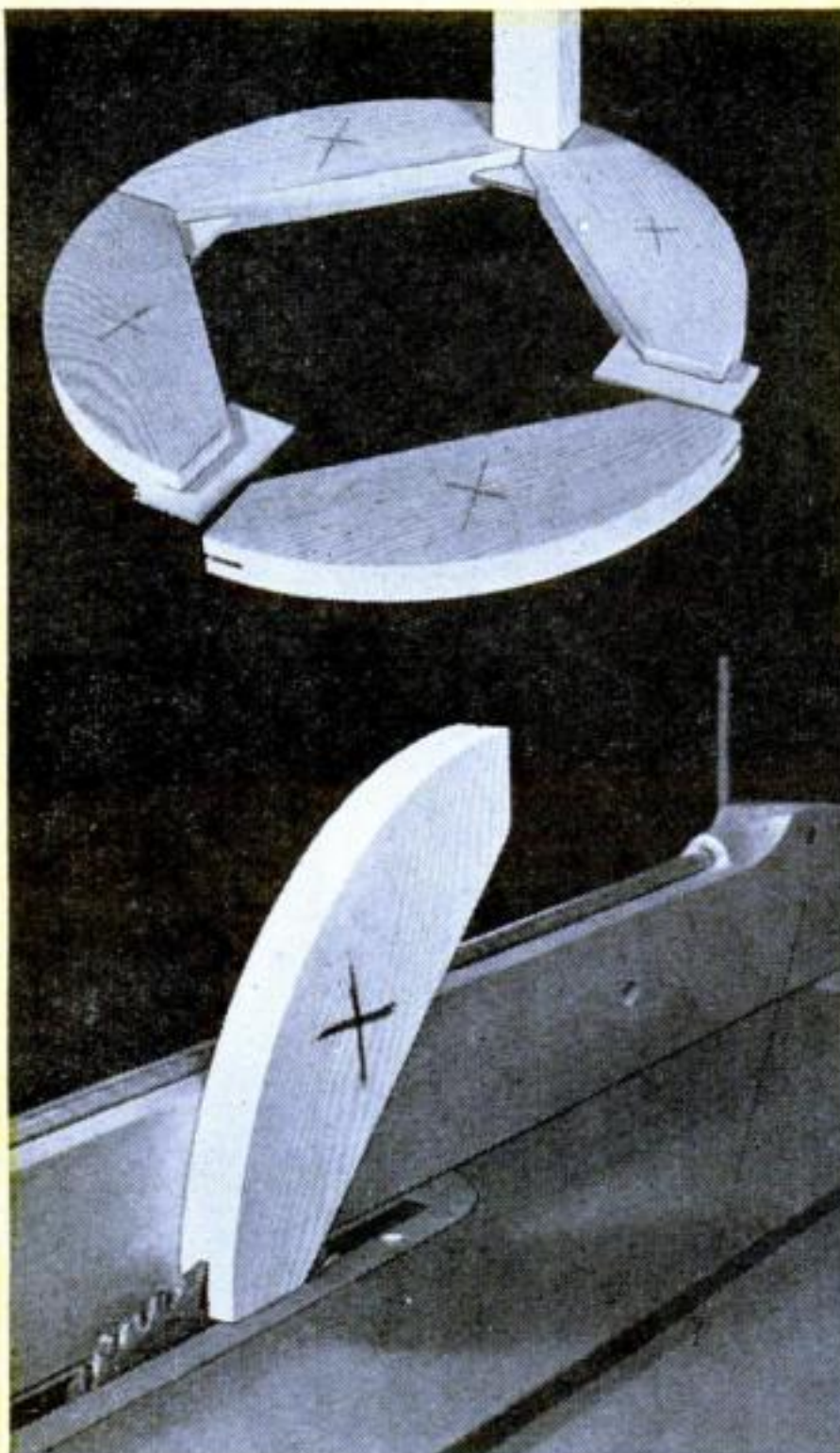
FEET FOR TUBING or bar-stock legs are available in various forms. Everything you see above can be bought at hardware counters. Most of the tips are resilient to protect floors. Steel glides such as the one at right are held by wood plugs driven into the tube.

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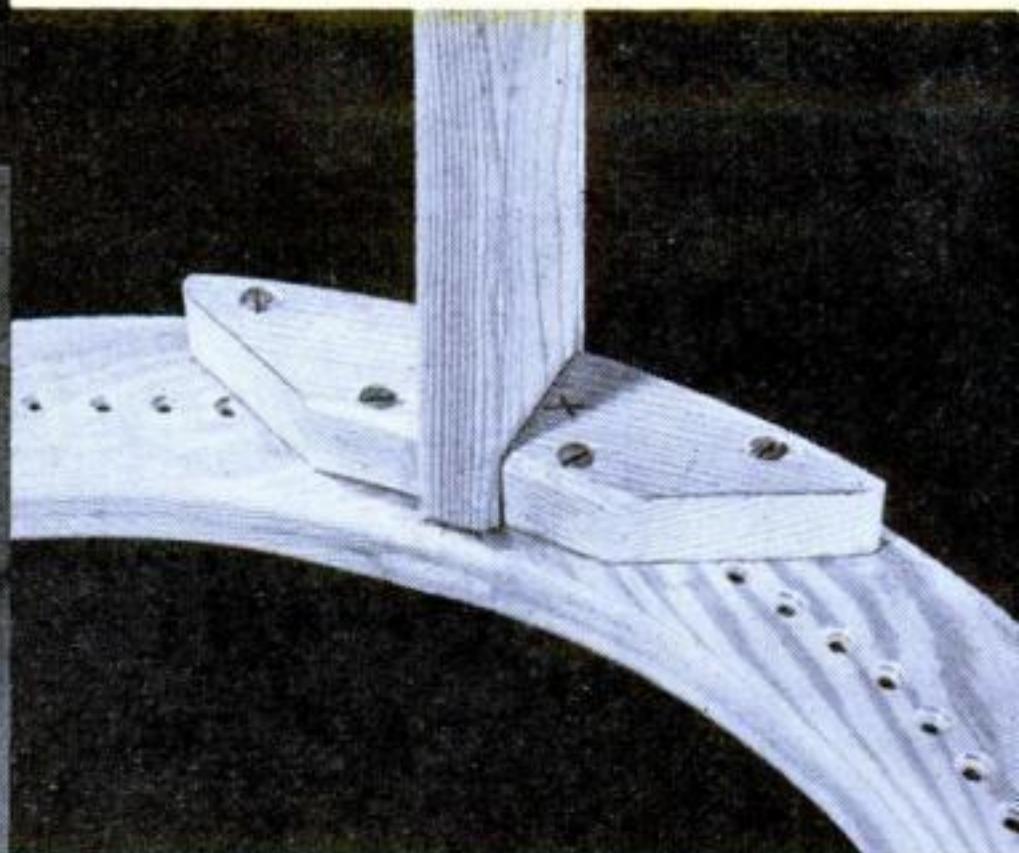
Building a round-seat chair



SEGMENTS assembled with splines wind up as strong circular frame. Cut out inner circle after all parts have been glued together. The splines should measure $1/4"$ by $1\frac{1}{2}"$ by $2\frac{1}{4}"$.



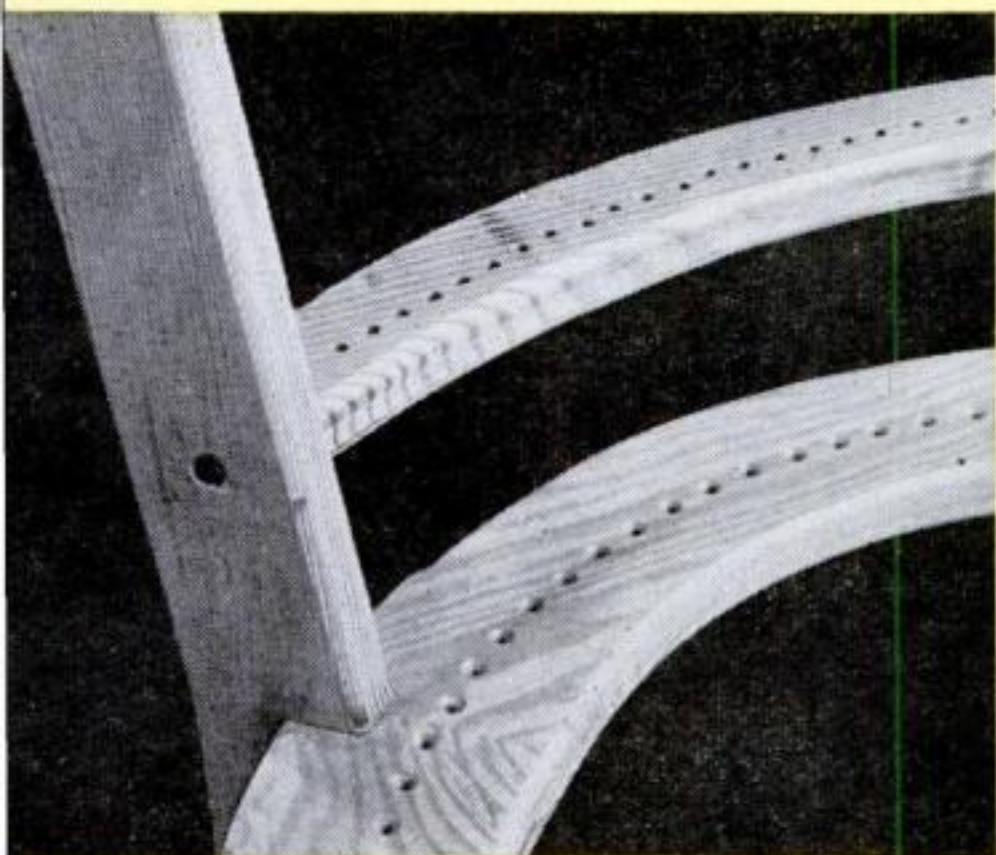
CUT SPLINE GROOVE after segments have been formed. Mark similar surfaces. Make the cuts with the marks on the same side of the saw blade and you needn't try to center groove.



GLUE BLOCKS UNDER THE FRAME to reinforce the legs. The procedure: Glue and screw one block in place, add the leg by gluing and screwing into the block, and finally add the last block.



WOODEN FRAME with a round seat and curved back drilled for cane is a rewarding project.



SEAT FRAME slips into notch cut in leg-back part. Place the bottom back piece $2\frac{1}{4}$ " above the seat. Decide on hole size after choosing weaving material. Countersink holes slightly.

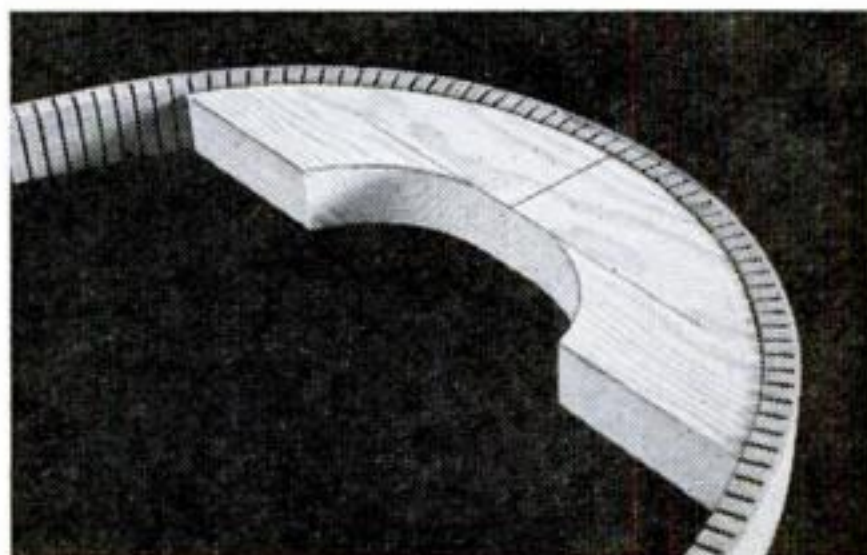
bend area. To minimize this, use the old dodge of packing the tube with damp sand before you make the bend. Tamp the sand with a dowel.

You can skip bending entirely by using commercial fittings, sold as accessories for copper pipe, electrical conduit, and do-it-yourself aluminum. This greatly simplifies construction. You work only with straight tubes, easily cut to exact lengths. Most troubles with bending arise in making the bend in exactly the right place on similar pieces of tubing.

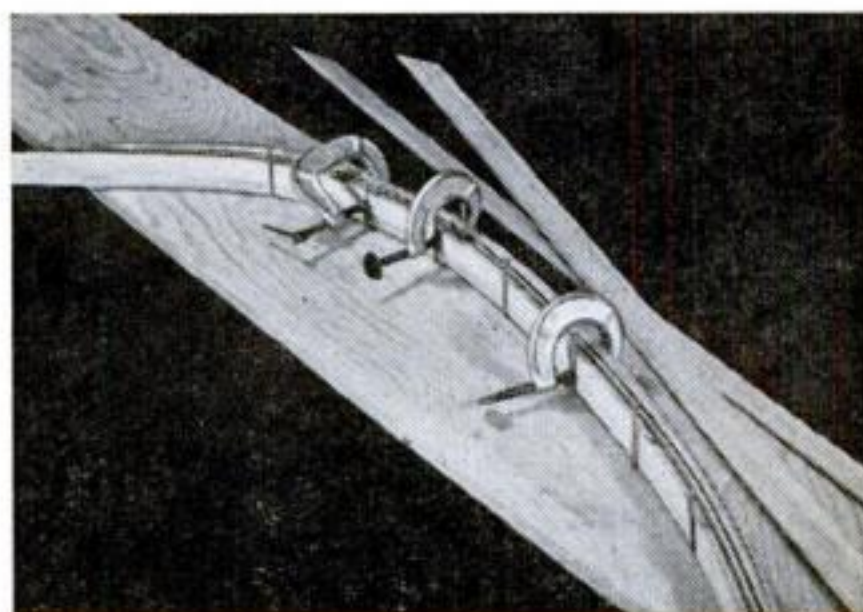
On do-it-yourself aluminum, fittings are mechanical; you just drill holes and turn in screws. This is something to remember for knock-down projects. Fittings for copper pipe and tubing are sweat-soldered.

There are two special items you should have—a V block (cut a V in a two-by-

Two ways to curve wood

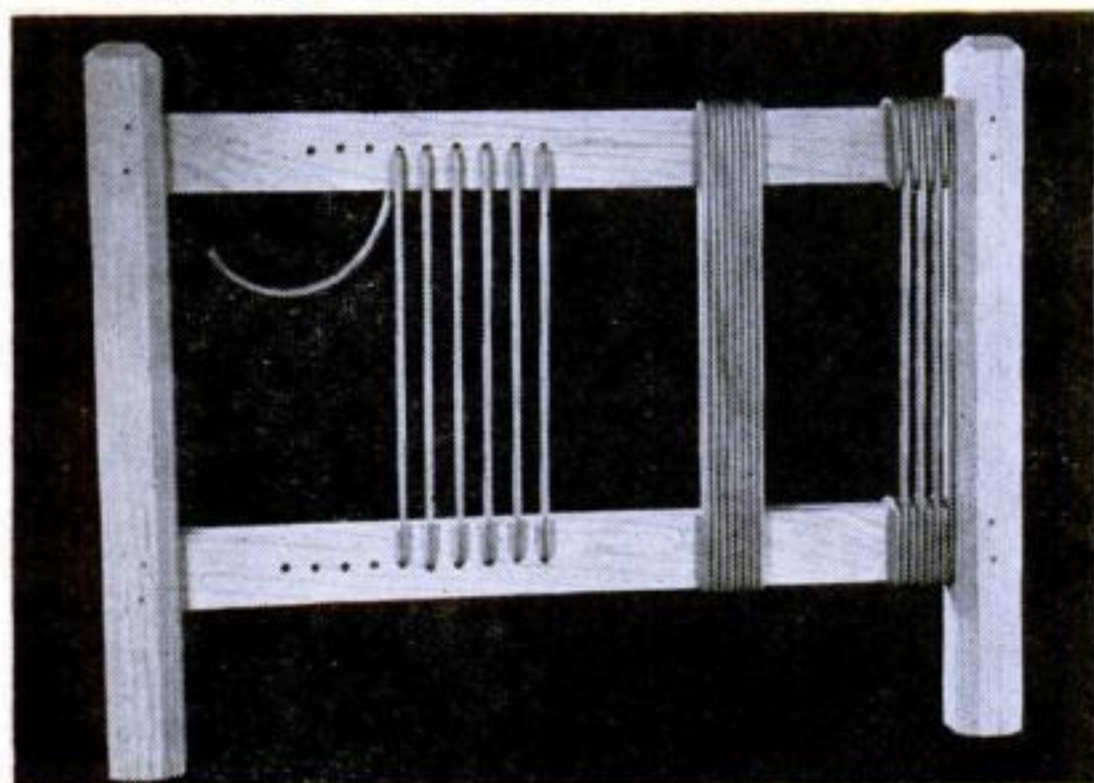


PIECE OF KERFED WOOD bends easily but has little strength. A piece like this can be used as chair apron. Attach the legs to seat or to strengthening blocks glued inside the apron.



THIN STRIPS can be laminated to make heavy curved pieces. Sometimes you can use nails for a jig; as above. Build up the laminations one piece at a time, letting the glue set.

Here are ideas for the seats and backs



THREE WAYS TO USE CORD on a chair back, straight or curved, are illustrated above. Nylon cord and plastic clothesline are both good. Other techniques are sketched in panel below.

Simple way to weave with cane

SOAK CANE BEFORE USING;
KEEP SHINY SIDE UP

USE AWL OR
WOOD PEG
TO HOLD
STRANDS
AS YOU
WEAVE

END VERTICALLY

DOUBLE
STRANDS

SINGLE OR
DOUBLE
STRANDS

SEAT

BACK

8 SPACES
(ACTUAL SPACING OPTIONAL)

3 seats for tubing chairs



four), for drilling accurate radial holes, and a tube cutter. The latter beats sawing and filing.

Metal tubing can also be combined with wood. Special flanges are now available for attaching pipe legs to wooden frames. If you want to slant the leg, use a wooden wedge between the flange and the seat. Nonthreaded tube (aluminum or copper) can be attached by plugging the tube tightly with a dowel and using the lock-wedge technique either hidden or exposed.

Round-seat wooden chairs. The strongest assembly consists of a circle formed of segments. You can control grain direction and eliminate weak points. You could use one piece of plywood, of course, but this would involve banding exposed edges and would eliminate, for all practical purposes, rounding off edges, as was done in this case.

A splined joint will probably prove easiest, since the groove can be formed after the segments are shaped.

Laminated wooden strips or kerfed strips can be used for forming curves and circles. But don't assume the piece can be bent any old way simply because it's thin.

For sharp turns, soak the bend area thoroughly. Best bet is to hold it in boiling water, testing it occasionally, until it's pliable enough to make the turn. Hardwoods such as oak, ash, and walnut bend best.

The kerfing technique is good for circular aprons if you attach heavy blocks to the inside to take the legs and the user's weight. And don't neglect the kerfing method when it comes to solid, curved backs. Plywood will respond to this treatment, too. Kerfs can be hidden with a sheet of glued-on veneer. ■ ■

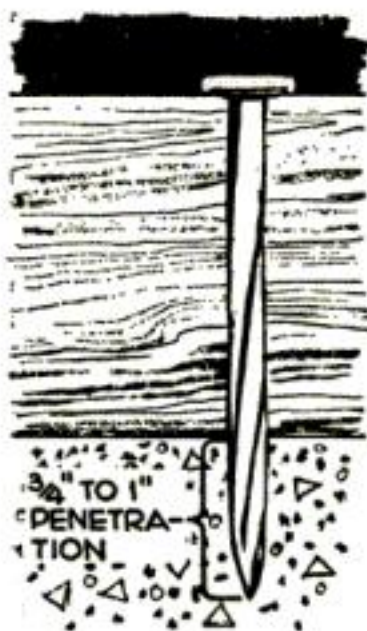
Nailing Know-How File



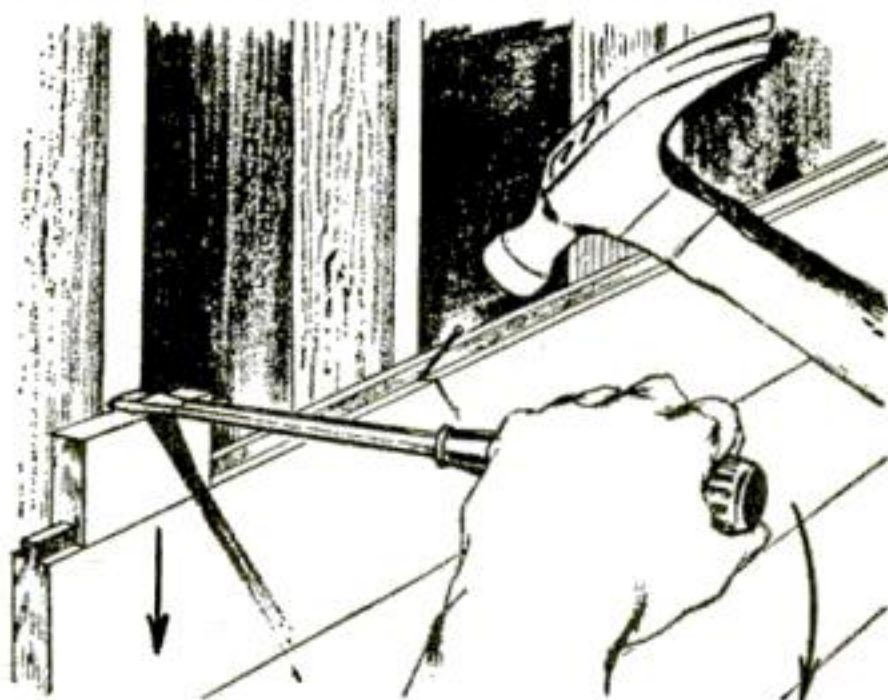
In nailing flooring, whether you are installing a new floor or silencing squeaks in an old one, remember that spiral (helical-thread) nails have more holding power than wire brads or cut nails. For squeaks, angle them into a joist (above).

Rustproof nails for outdoor work prevent rust streaks or spots that bleed through paint. Galvanized nails are cheapest, but hammer blows can flake the coating off their heads. Copper and aluminum nails won't rust, but they're soft and tricky to drive. When appearance counts, use stainless-steel ones.

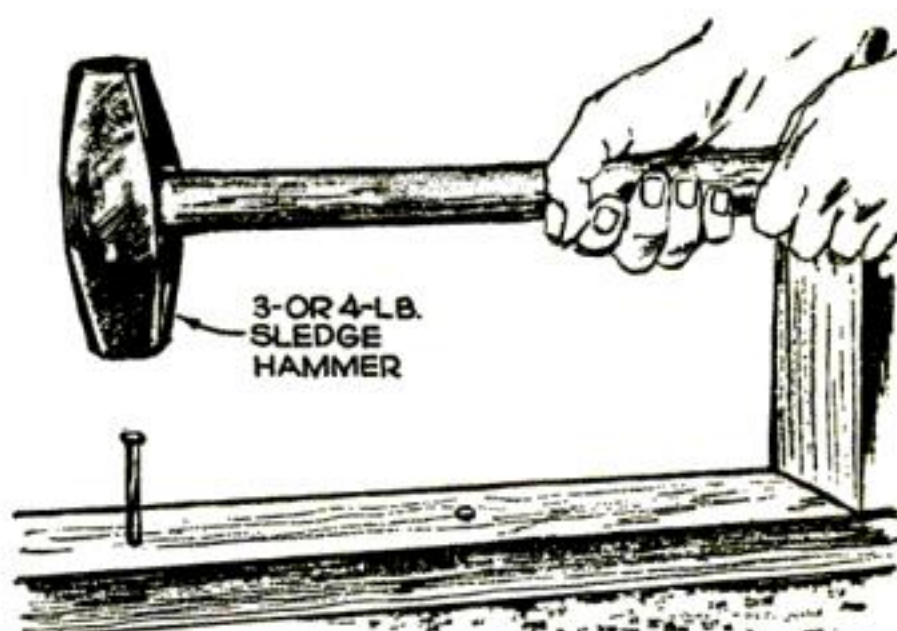
Nailing into concrete calls for hardened-steel nails—grooved ones give best holding power. Use a 3- or 4-lb. sledge to drive them with fewest blows (right). Pecking makes for loose holes. Don't try to get by with fewer nails by using longer ones.

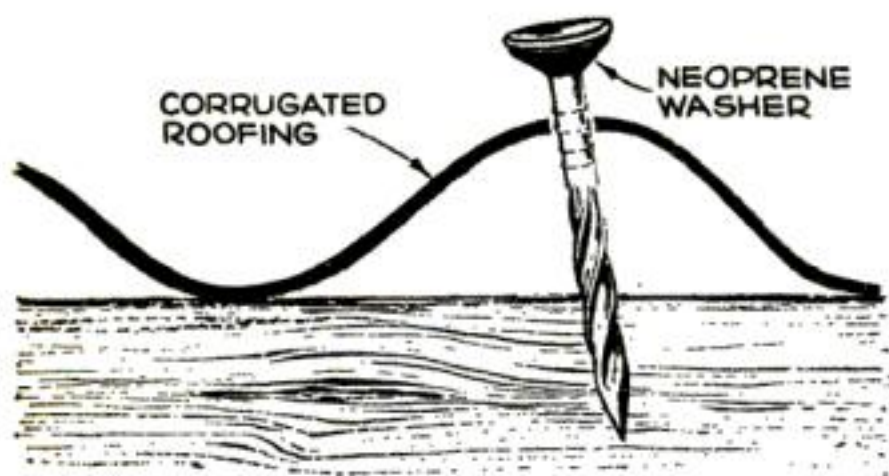


Nailheads won't show if you drive eight-penny finishing nails through the tongue of T&G paneling. For tight joints, or to force warped boards together, tap a lever lightly into a stud as below, and pry down on a block cut from the grooved edge of a piece of scrap. Then nail.



If wood splits, the joint is weakened, and you'd do better to use a smaller nail to avoid splitting. Most people use common nails for home jobs, but box nails—which look like them but are slimmer—are often the choice of experienced carpenters when splitting is a problem. An alternative is to predrill the nail holes.





To fasten corrugated roofing, drive nails at a slight angle through the crest of the corrugations. You get a neater job by drilling holes for the nails. A neoprene washer under the head seals against leaks. If you want a lasting job, use steel nails on steel roofing, aluminum nails on plastic or aluminum roofing.

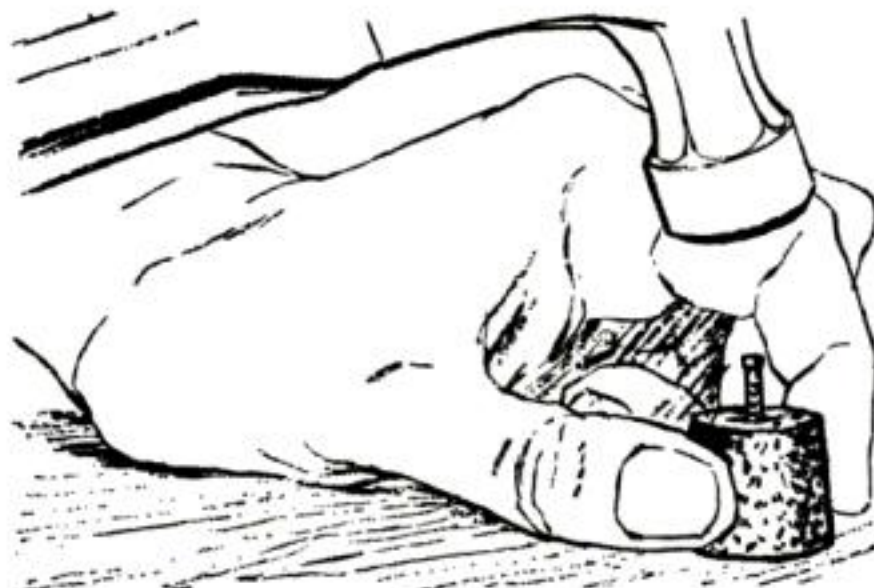


Pole-construction nailing presents a problem: Creosoted lumber lubricates nails driven into it, reducing their holding power. Yet the poles must support the entire structure. Use special spiral-thread nails of hardened steel. They're slim to avoid splitting, strong to resist bending, and come in lengths up to 9".

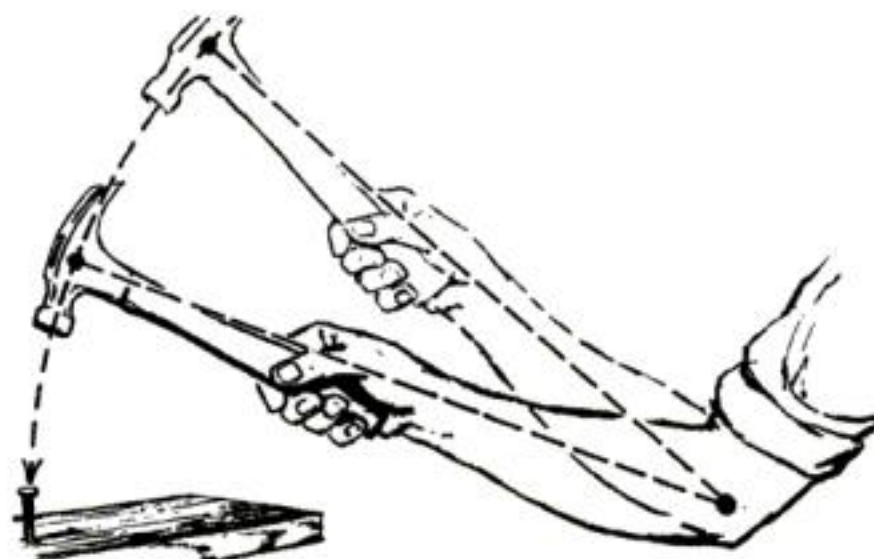
When nails bend, the trouble may be in how you drive them. The arc and the power are much greater when your swing pivots from your elbow rather than your wrist. A heavier hammer can reduce the driving effort and thus true your swing. Many carpenters say a rip hammer (straight-claw) gives better balance.

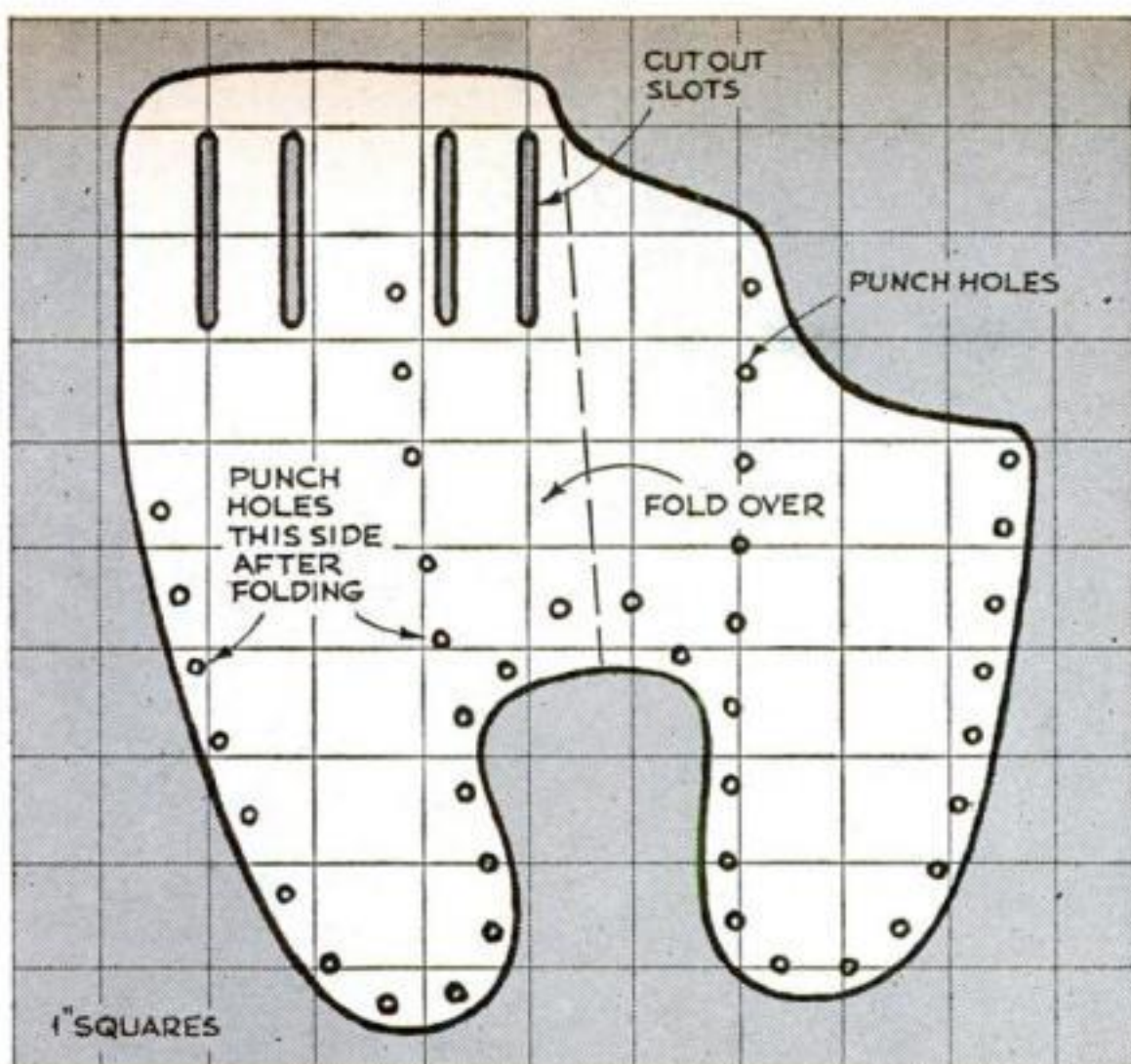


Face-nail hardboard panels. Never try to nail into or toenail through the edges. Use hot-galvanized screw-thread nails to apply panels directly over studs. Space nails 4" apart along edges, 8" inside.



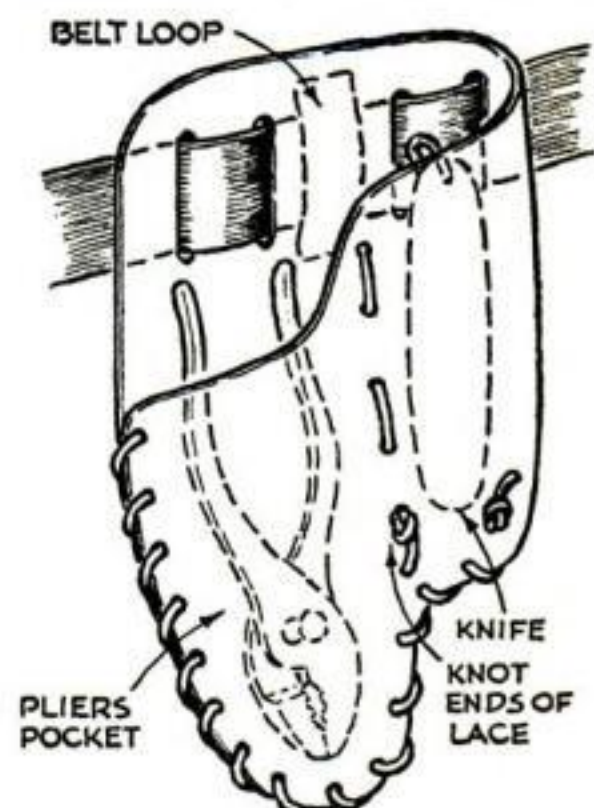
Driving thin brads. To avoid bending, push a brad through a cork, as shown, and set the cork firmly against the surface. Drive the brad out of sight, pull the cork up over its head, and tap flush.





Short Cuts and Tips

FROM PS READERS

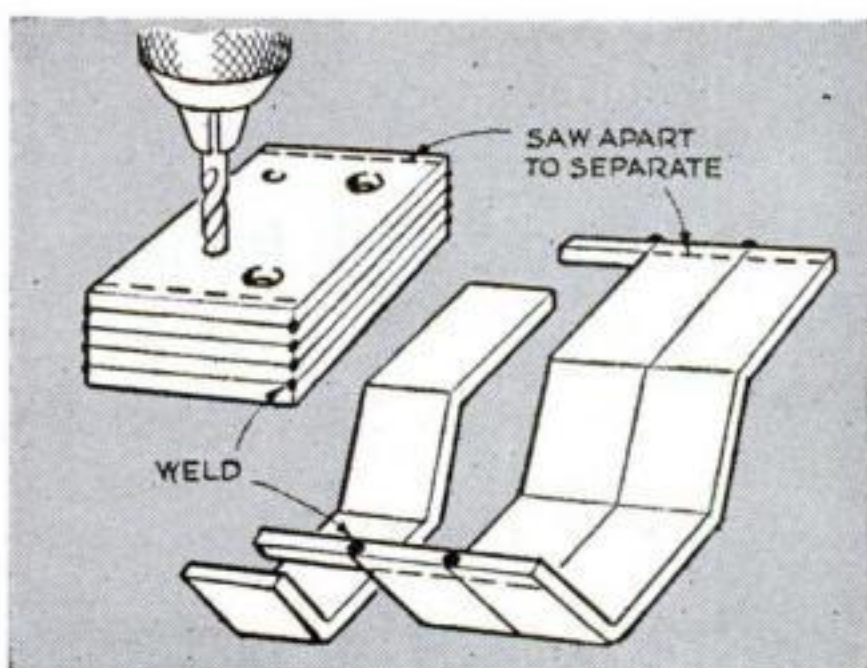


Electrician's Tool Holster

I'M THE fastest draw in the Midwest—among electricians, anyway.

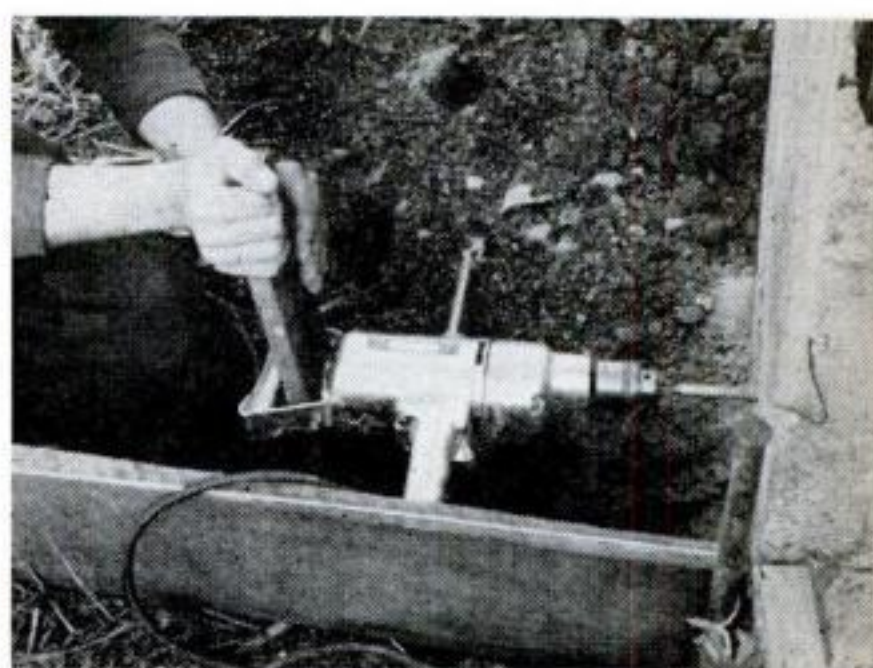
The tools of my trade—pliers and the big electrician's knife—are awkward to carry in a pocket. So I made the holster sketched above from a 9" square of

leather. Located so that it brackets a belt loop, it can't slip to either side. On the pattern, holes are indicated for lacing with a leather thong, but the two halves could also be sewn together. Cut the same pattern for a left hip holster; just fold the short half the other way.—*John Curoe, Bernard, Iowa.*



Tack-Weld for Duplication

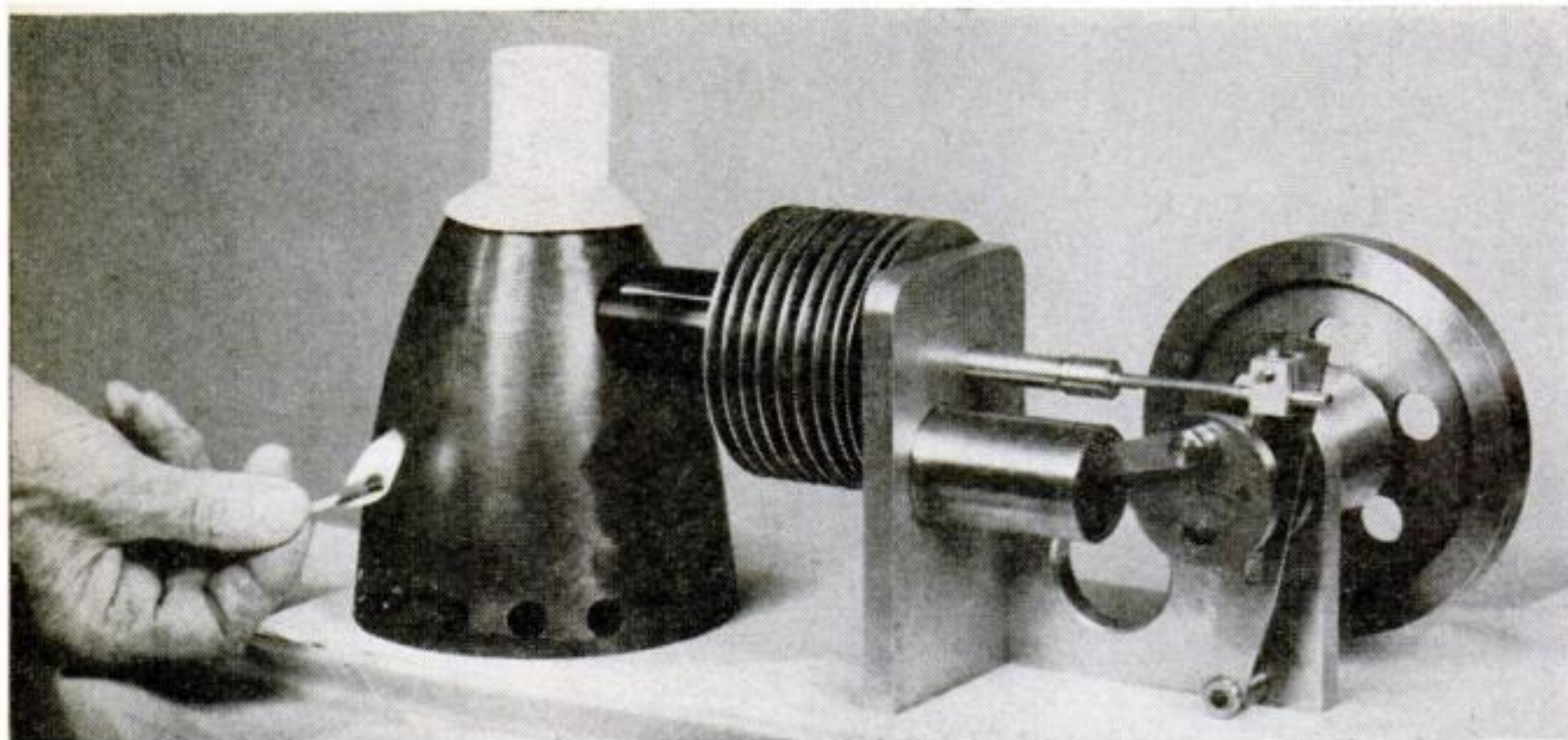
NEED to bend several strips of steel to identical shapes? You can work them all at once if you cut them slightly long, place them side by side, and tack-weld them together at each end. After bending, separate the pieces by sawing off the welds. Use the same method when drilling duplicate plates. In this case, of course, the blanks are stacked before welding.—*J. R. Harman, Grand Rapids, Mich.*



Lever for Drilling Pressure

EVEN with a carbide-tipped bit, drilling into concrete can be tough going. Unless you slow the drill by putting a load on it, the bit spins too fast to get a bite. One way to apply extra pressure (when working on a low, exterior wall) is to sharpen the end of a one-by-three and tap it into the earth behind the drill for leverage, as shown above.—*R. J. De Cristoforo, Los Altos Hills, Calif.*

My PRIZE project is...



...a double-size hot-air engine

This little beauty is an almost exact copy of the hot-air engine built by Harry Walton for last April's PS, except that I scaled it up to twice the size. I also doubled the number of cooling fins to handle the increased load.

The bigger displacer piston was built up from aluminum tubing with both ends welded in instead of the crimping arrangement. It's important in this case to provide a vent hole to let the gases

escape during welding. I did this by drilling and tapping the piston-rod hole part way into the end piece. Then I continued on through with a tiny No. 60 drill to make the vent. When the piston rod was screwed in, it sealed the hole. I also added a second slot in the crank disk so I can reverse the engine by simply switching the power crankpin from one slot to the other.

RALPH CULP, Springfield, Mo.

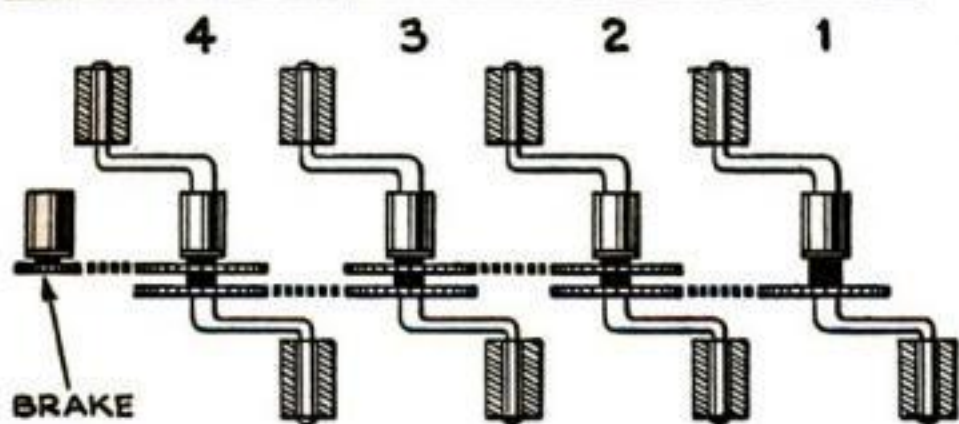


...a bicycle built for four

Everybody told me it couldn't be done, but here's the proof—a four-seater bike. It consists of the front sections from three frames, plus a full frame at the rear, welded together. I had quite a time figuring out the drive since all sprockets and chains had to be the same size to keep the pedals in unison. I finally settled on the system shown in the sketch (left), alternating the chains on double 46-tooth sprockets.

Beefed-up wheel spokes and tires support the load. The hind wheel has a gear-shifting hub, and internal brakes on both wheels make up for the lack of brakes on the intermediate frames. With a full crew I've hit 44 m.p.h.

W. E. REDBROOK, Clarksburg, W. Va.



**A Popular Science first . . . For space and convenience
you never dreamed possible, try—**

The Walk-Around, Work-Around Shop Bench

By Jackson Hand

THE trouble with most workbenches is that they're jammed against a wall or into a corner. You can work at only one side. It's a long stretch to reach tools hung on the wall behind it. In time, the back edge invites an accumulation of clutter and soon you've lost half the top area, too.

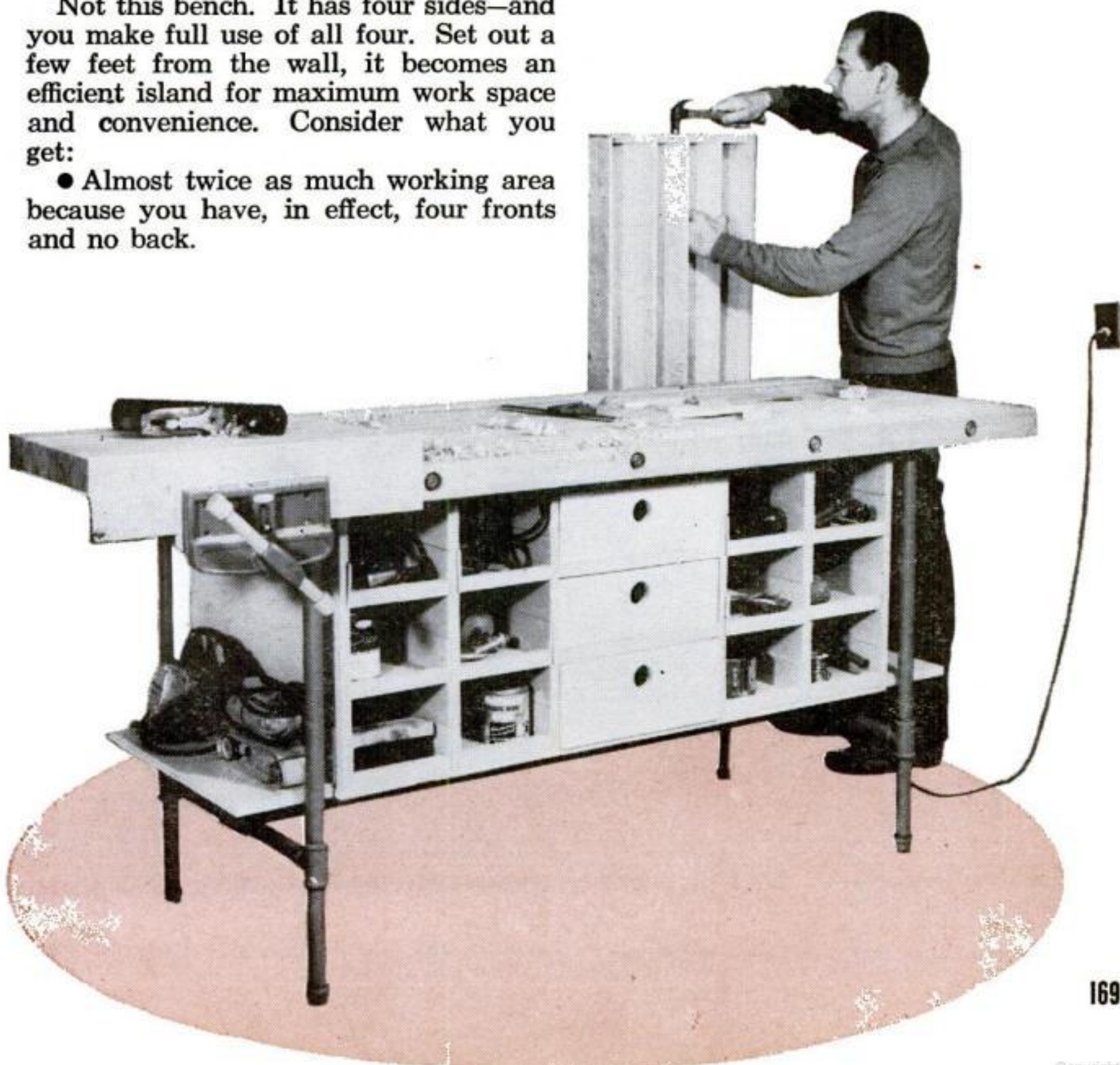
Not this bench. It has four sides—and you make full use of all four. Set out a few feet from the wall, it becomes an efficient island for maximum work space and convenience. Consider what you get:

- Almost twice as much working area because you have, in effect, four fronts and no back.

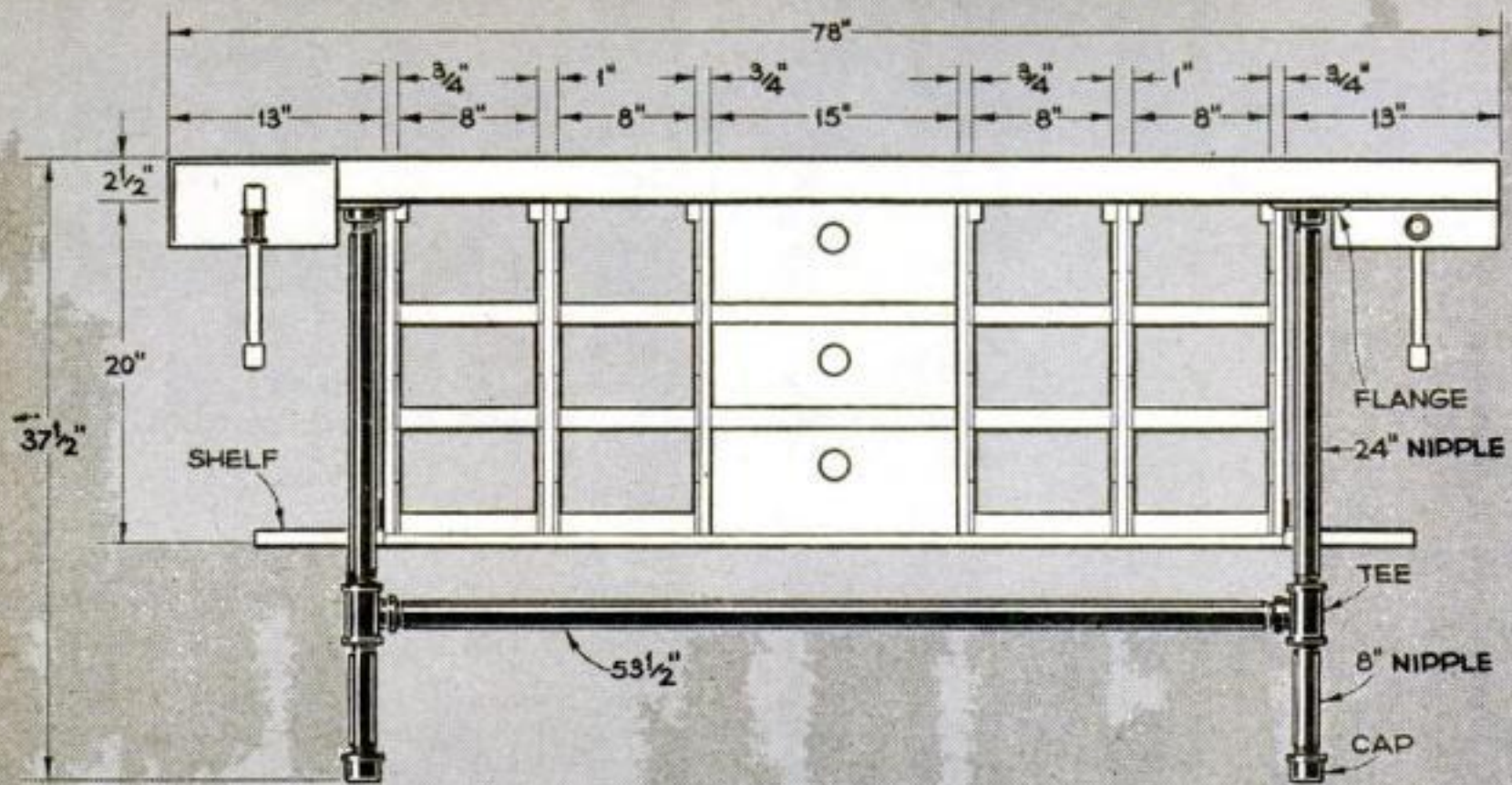
- Easy access to your project—just position it once and you can reach all sides without disturbing the setup until the job is completed.

- Full under-bench storage in handy two-way, pass-through trays and drawers that slide out from either side—you can reach whatever you want from wherever you are. Drawer space isn't wasted

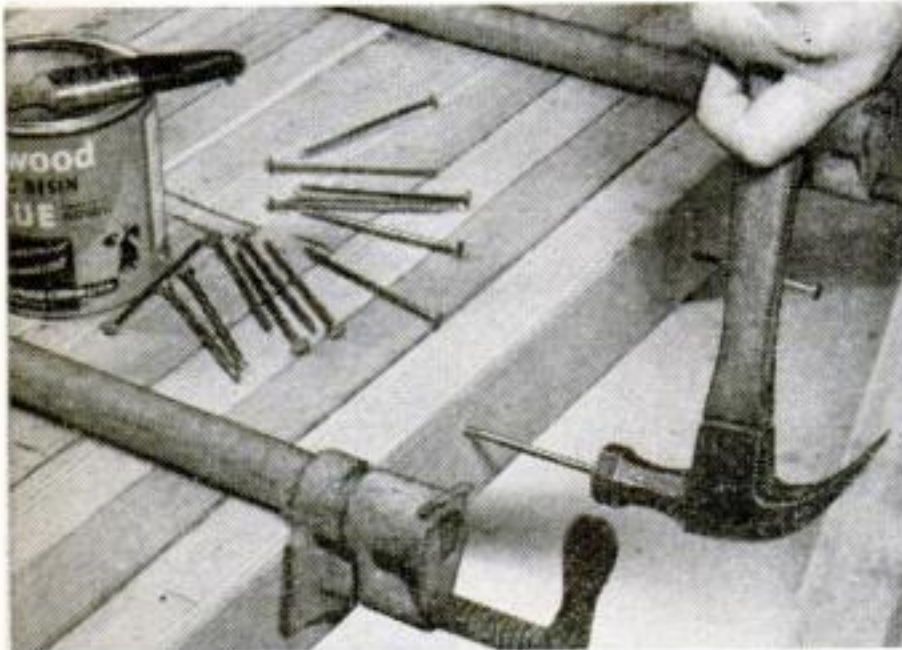
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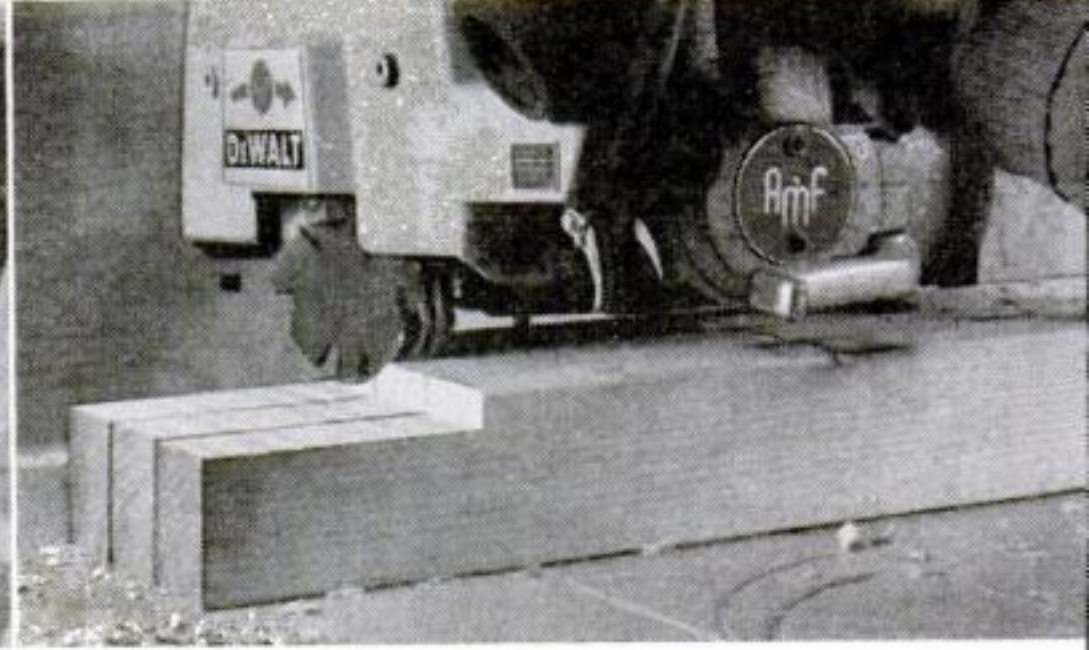
A screw-together pipe frame supports the top, with trays and



The bench top is a sturdy slab of laminated two-by-threes



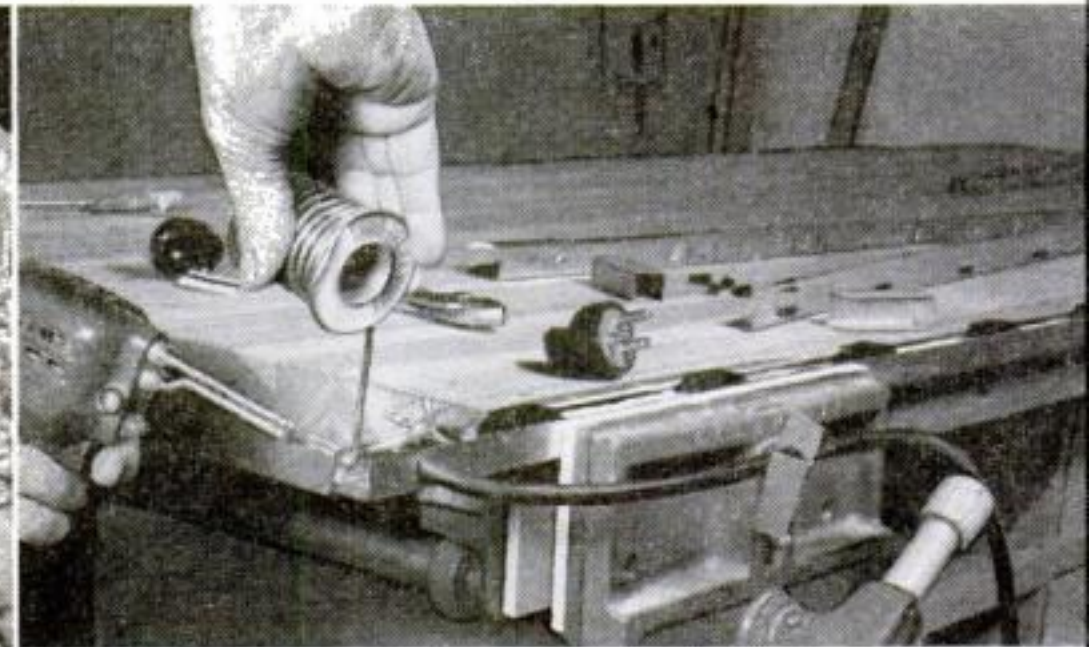
BUILD UP THE TOP a strip at a time if you prefer to avoid long bolts. Glue and nail each new strip to the last one until the sandwich is complete. Use pipe clamps to align strips.



MORTISES ARE EASILY MADE if you notch the strips before assembly. For the vises, make L-shaped cuts like this. U-shaped notches at top of strips create the jig-holding mortise.

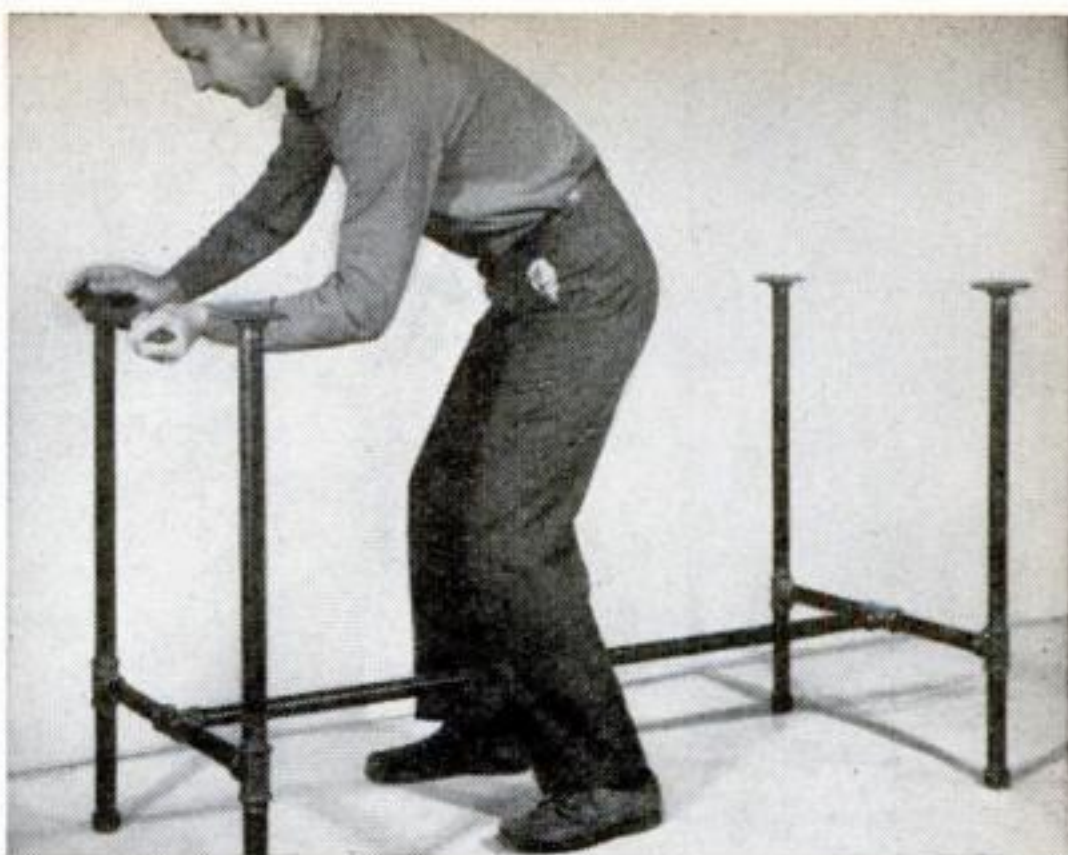
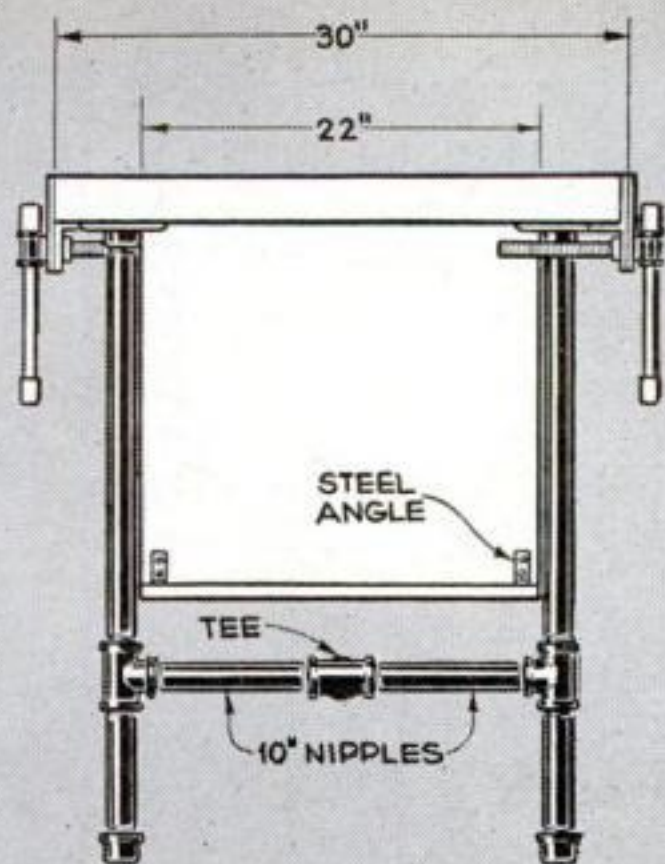


DIAGONAL PLANING across the strips helps to give a smooth, level top. Finish with sanding and a penetrating sealer that will toughen the wood without making it shiny and slippery.



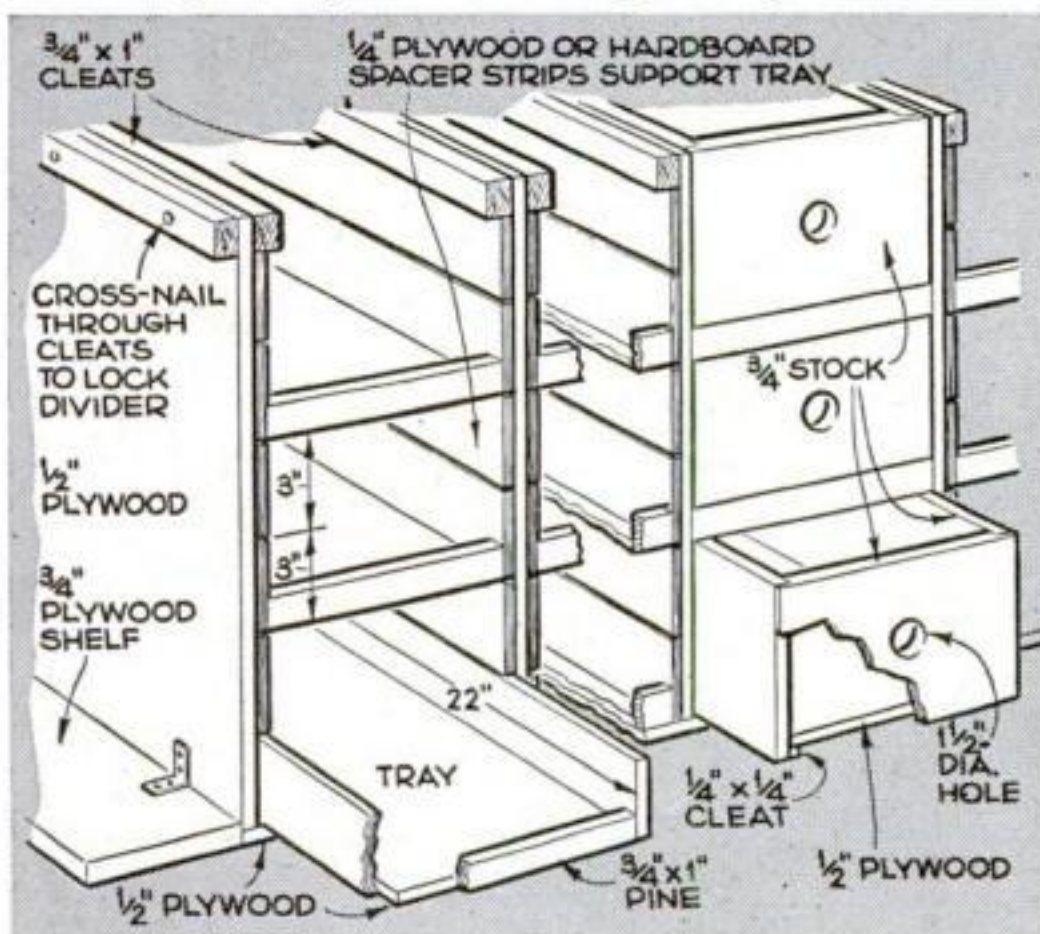
TO ELECTRIFY THE BENCH, continuous-strip outlets can be screwed under each side. Be sure to use three-wire cable, and solder the ground wire to the metal raceway, as shown here.

drawers slung underneath



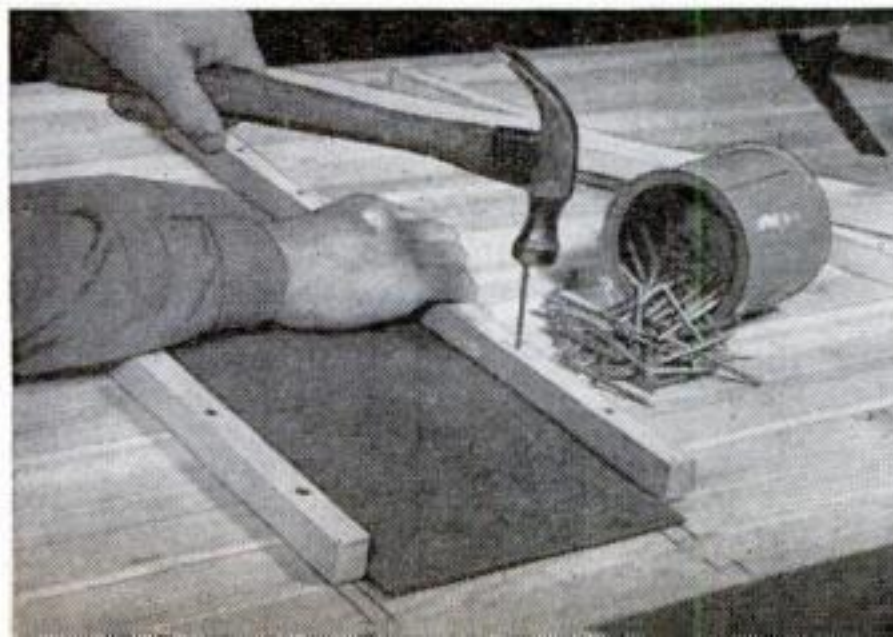
STOCK LENGTHS OF PIPE, bought prethreaded, make the legs an easy assembly job. Only the long cross brace must be cut to order. Joining the parts is no problem if you complete the entire frame before attaching the top.

Making the pass-through trays and drawers



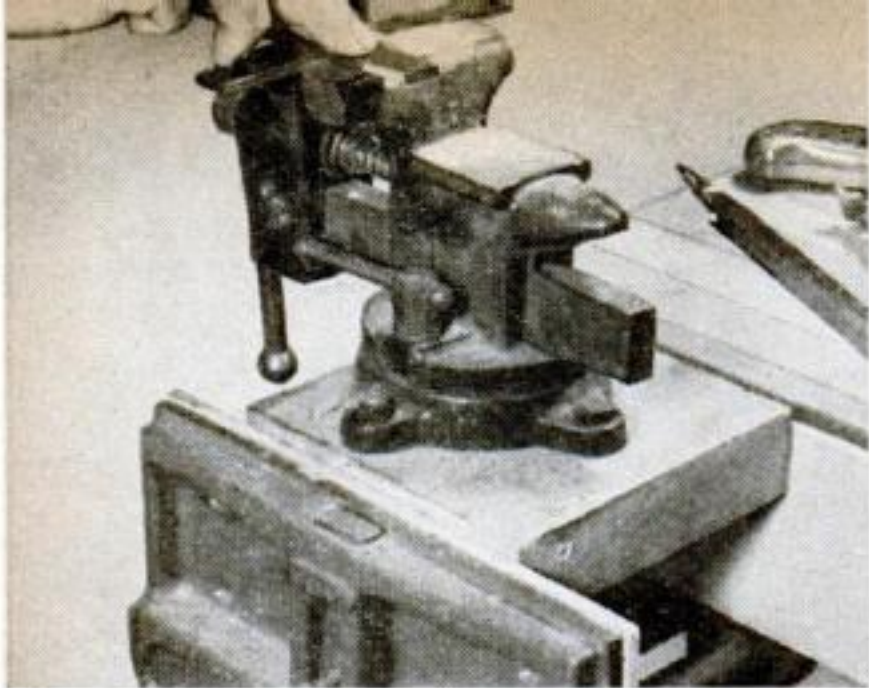
STORAGE COMPARTMENTS are hung from pairs of cleats on underside of the top. Use a gauge strip cut from hardboard, as below at left, to be sure cleats are accurately spaced and parallel. Fasten only first of each pair at the start, then insert the hanging member and nail second cleat through it into the first. Finally,

fasten second cleat to the top. This provides a strong, interlocking joint to support the suspended weight. For the drawers, fasten $\frac{1}{4}$ "-square cleats around the lower edges, as below at right, to hold the bottoms loosely so they'll lift out for cleaning. The drawer pulls are simply 1 1/2"-diameter holes.

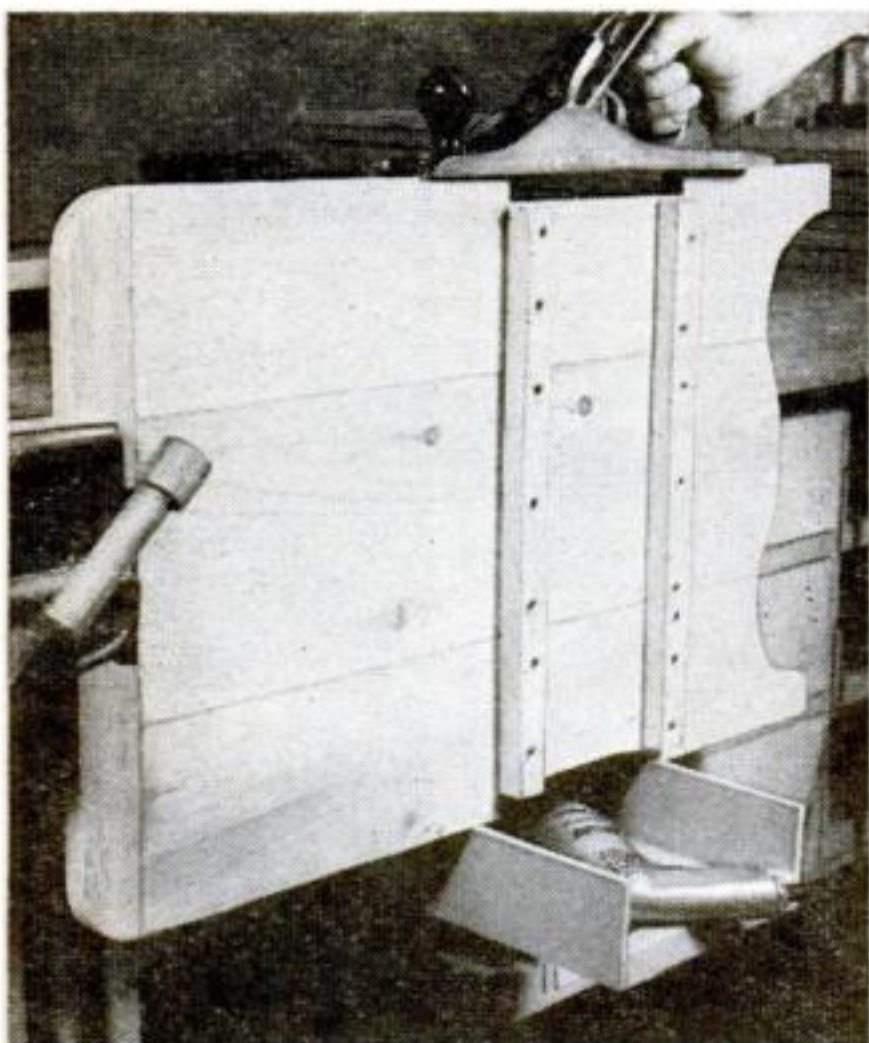


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METALWORKING VISE, mounted on a wood block, is clamped in bench's woodworking vise when you need it. When not in use, vise is removed, and bench top is free of obstructions.



DOUBLE-DUTY TRAYS serve as handy pull-out supports to help hold large work clamped in the vises. Note how the trays also keep tools neatly stored yet ready for immediate use.

because there are just no "dead" areas.

- Doubled tool-board space since the wall behind the bench is now freed for full, floor-to-ceiling storage. To get a tool, you merely turn or walk to it instead of leaning across the bench. Access to tools is never blocked by the project you're working on.

- Twin woodworking vises, one on each side at opposite ends—you can keep two projects going at the same time.

- A completely unobstructed bench top, allowing large projects to overhang in any direction. Even the metalworking vise is removable so that it won't get in

your way when you're not using it.

- Continuous outlet strips running the full length of the bench on two sides to let you keep power tools plugged in, ready for instant use. All cords pull neatly up from underneath instead of becoming a tangle on top.

- A bench-top jig holder that lets you insert interchangeable stops, V blocks, and other accessories.

- Quick clean-up, made possible by the easy-to-sweep-under open frame.

Worried about floor space? This out-from-the-wall bench takes little or no more room than most conventional types. The reason: The four-sided design gives you so much more usable work space that you can actually get by with a smaller bench. The 6½' length shown here is more than equal to an 8' or 9' against-the-wall bench that's half wasted.

The shorter bench just about makes up for the few feet you need between it and the wall. Besides, it's light enough to swing out of the way against the wall when not in use.

The free-standing frame. Legs of ¾" black-iron pipe make a simple yet sturdy and wobble-free underpinning for the bench top; it won't have to lean on any wall for support. All parts, except the one lower cross brace, are stock pipe-nipple lengths that you buy threaded for easy assembly.

The frame is anchored to the top through pipe flanges. Use the largest screws that the flanges will take. The frame is open at all ends so there's no problem of screwing together reversed threads. Assemble it as a unit first and then fasten it to the top.

Two ways to make the top. As shown, the bench top is made in the classic way—long threaded rods passing through a stack of two-by-threes set on edge. This is easily done if you use a drill press and jig to align the bolt holes accurately. To avoid bolting, there's another trick: Merely glue and nail the stack together a strip at a time, as shown in a photo.

You'll need 19 lengths of two-by-threes to make a top 30" wide. If you buy two-by-sixes and split them, you'll have a square edge on each piece to give a flat surface. Otherwise, run the pieces through a saw or jointer to remove the rounded corners. This will give you a

head start on planing down the final bench top smooth and level.

The two woodworking vises, at diagonal ends of the bench, will usually require mortises cut in the underside of the top to bring the jaws flush with the upper surface. Easiest way to do this is by notching out the bench-top strips before they're assembled, as shown. You'll also want to notch the fixed jaw of each vise into the edge of the bench so it will lie flush.

The bench-top mortise for holding the interchangeable jigs is made by cutting 8"-long notches in five of the 19 strips. When assembled, the notched strips form an 8"-square recess.

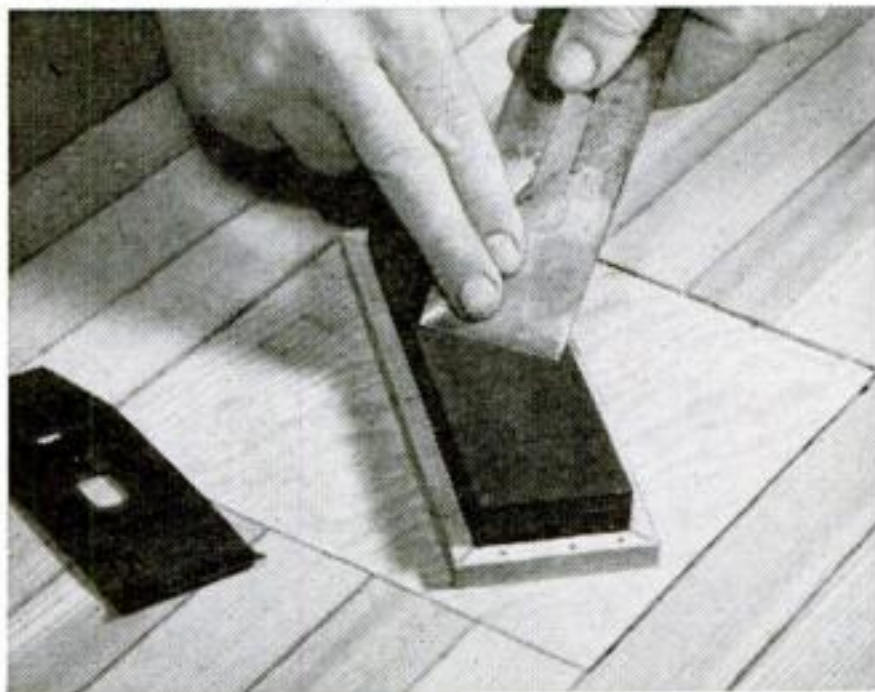
Hanging the understructure. The trays and drawers are suspended entirely from cleats on the underside of the bench top and don't touch the pipe frame. The vertical divider strips between compartments are $\frac{1}{2}$ " plywood, with a bottom also of $\frac{1}{2}$ " plywood. Use the method shown for side-locking the

tops of the dividers into the cleats so they'll support the suspended load.

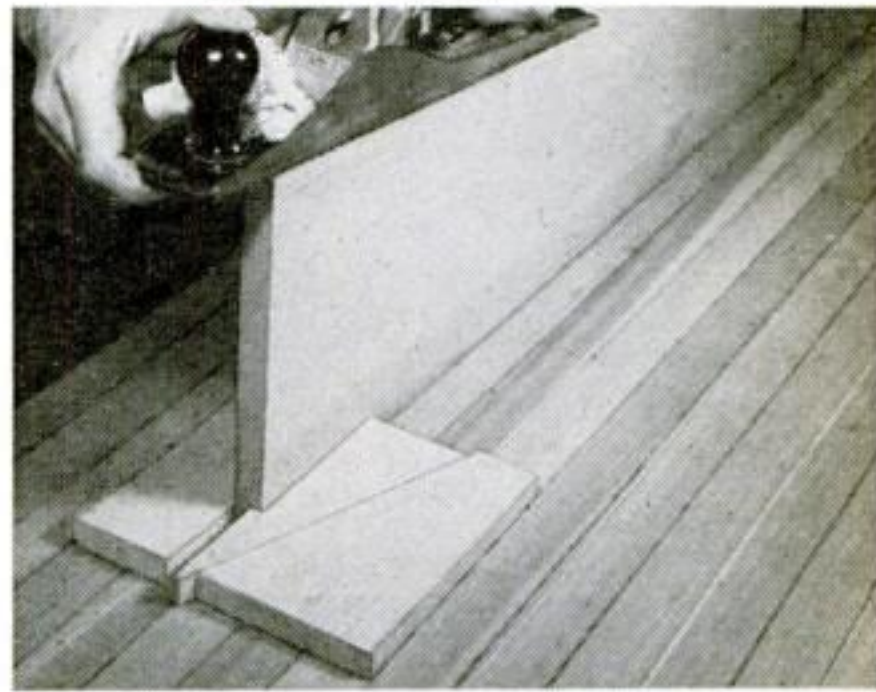
The guide rails for the sliding trays are ingenious—merely thin spacer strips glued to the sides of the vertical dividers. The sides of the trays, made of the same thin material, then form slides that fit between the spacer strips. The result is an almost invisible construction that gives the uprights a slim, one-piece appearance when the trays are closed.

The drawers are of conventional construction, rabbeted at the corners, except for one special feature: The bottoms rest loosely on $\frac{1}{4}$ "-square cleats so they can be lifted out for easy cleaning. The drawers slide on 1"-by- $\frac{3}{4}$ " cleats fastened to the plywood uprights. Similar 1"-high strips are also carried across the front, one under each drawer, to continue the horizontal lines created by the low tray fronts. Two small plywood shelves, bracketed to the ends of the tray compartments, give you additional storage space at each end of the bench. ■ ■

Look what you can do with these interchangeable jigs

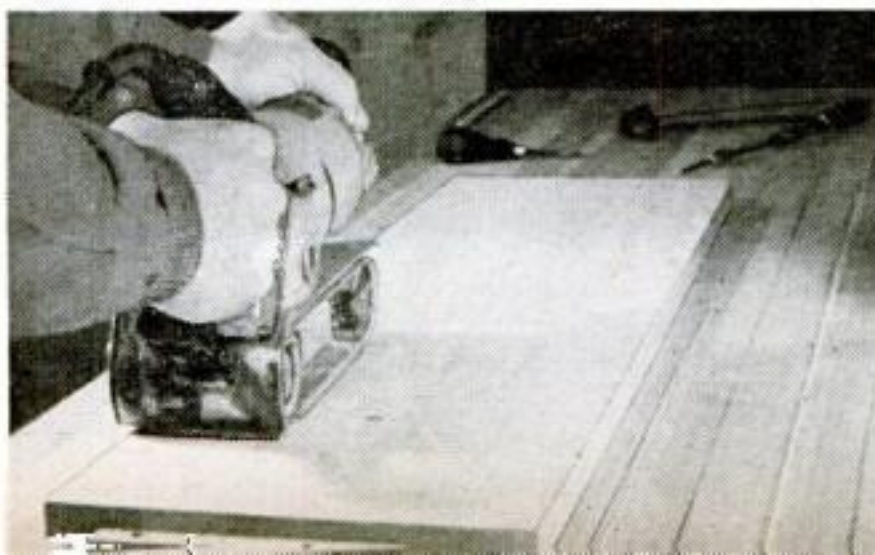


SHARPENING STONE, mounted on a plywood block above, quickly drops into the bench-top mortise for temporary use. When not needed, the mortise is kept filled with a plain block.

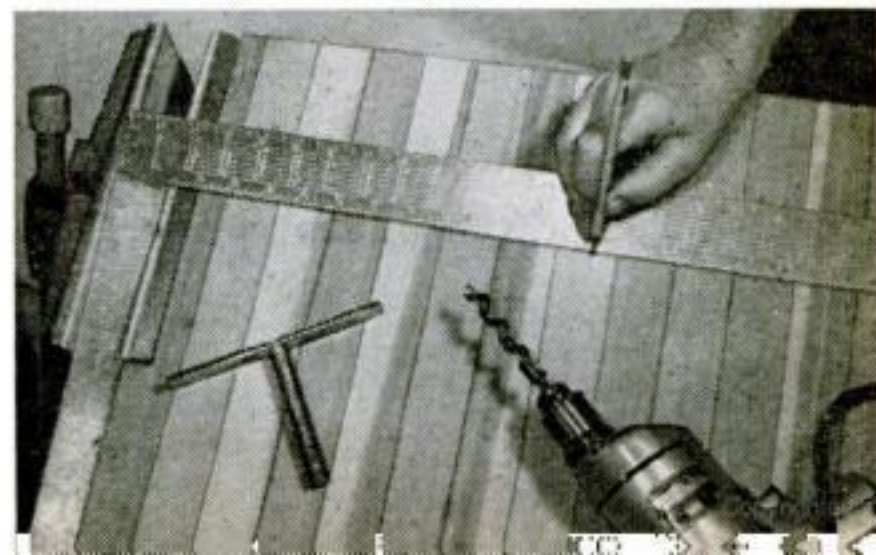


SLIDE-LOCKING WEDGE, held on another drop-in block above, grips boards of varying thickness on edge. Other possible jigs: V block, end-grain mallet block, and rough chiseling block.

DROP-IN STOP BLOCK holds work flat for sanding or planing. Bench-top mortise is formed by simply cutting U-shaped notches $\frac{3}{4}$ " deep across 5 of the 19 strips in the bench top.

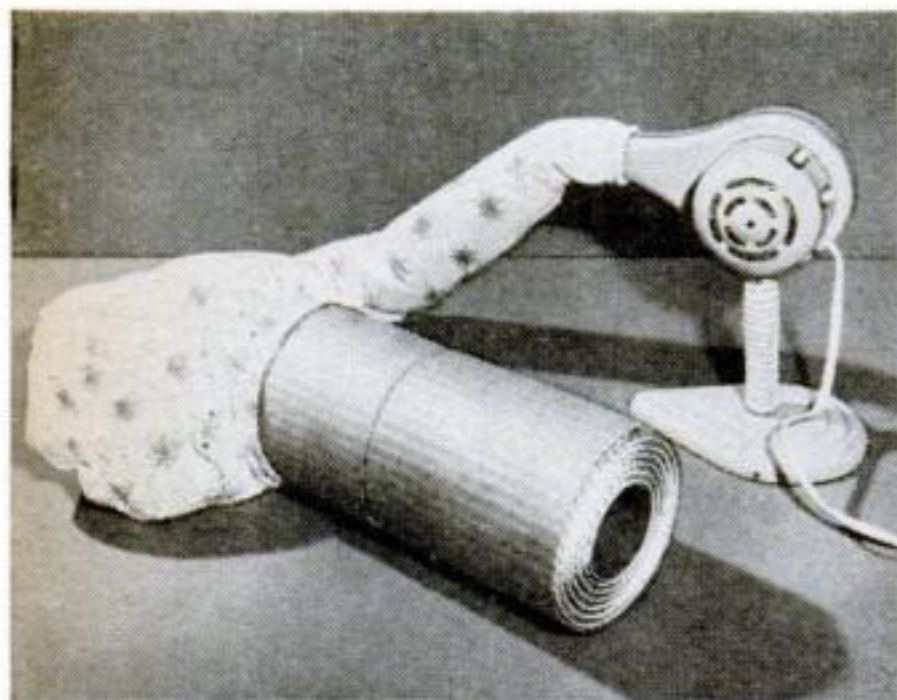
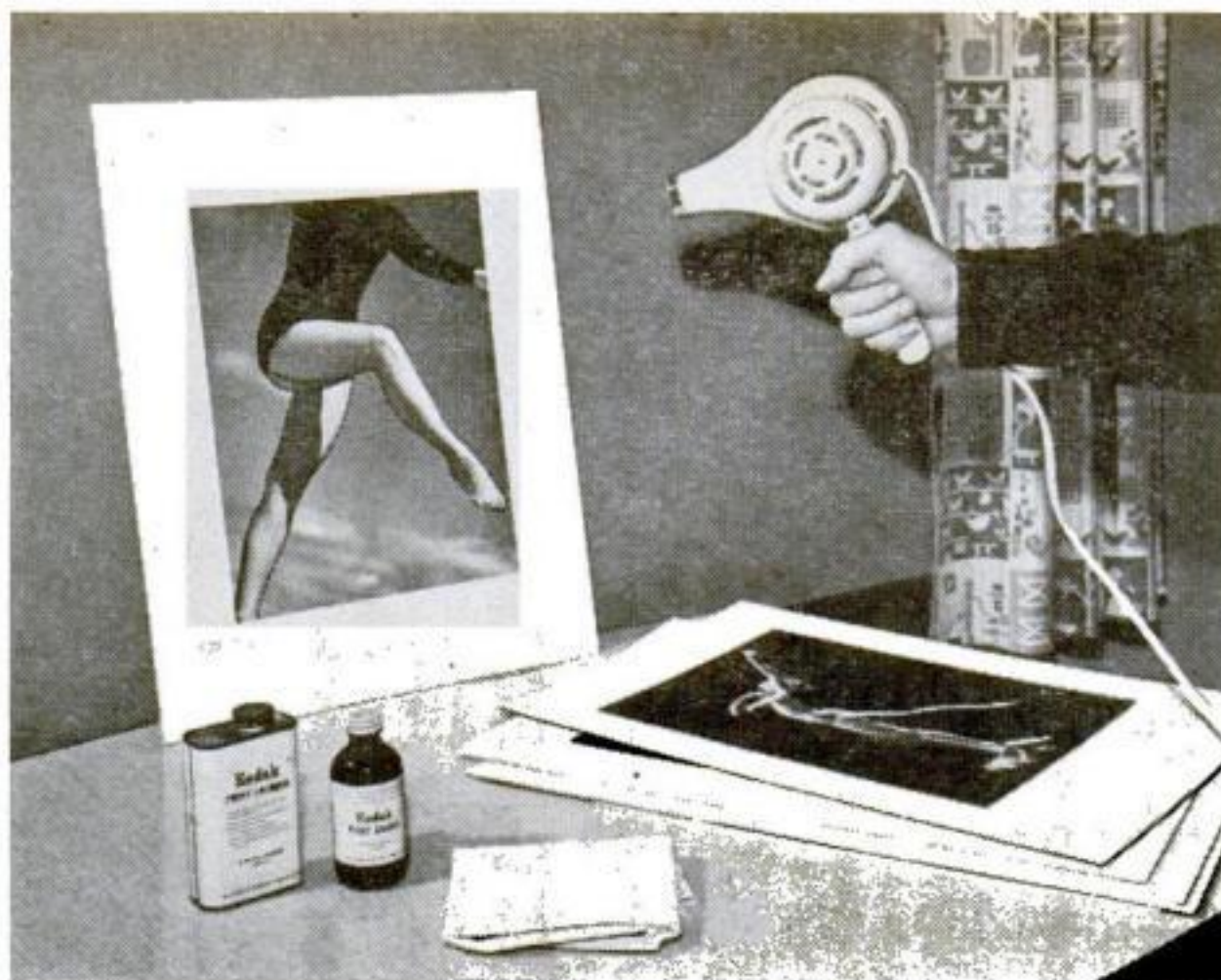


ANOTHER TYPE OF STOP is this T bar that drops into holes wherever it's needed. It's a short length of square stock welded to a pin. Locate holes a few inches apart at each end of bench.



Dark-room Uses for a Hair Dryer

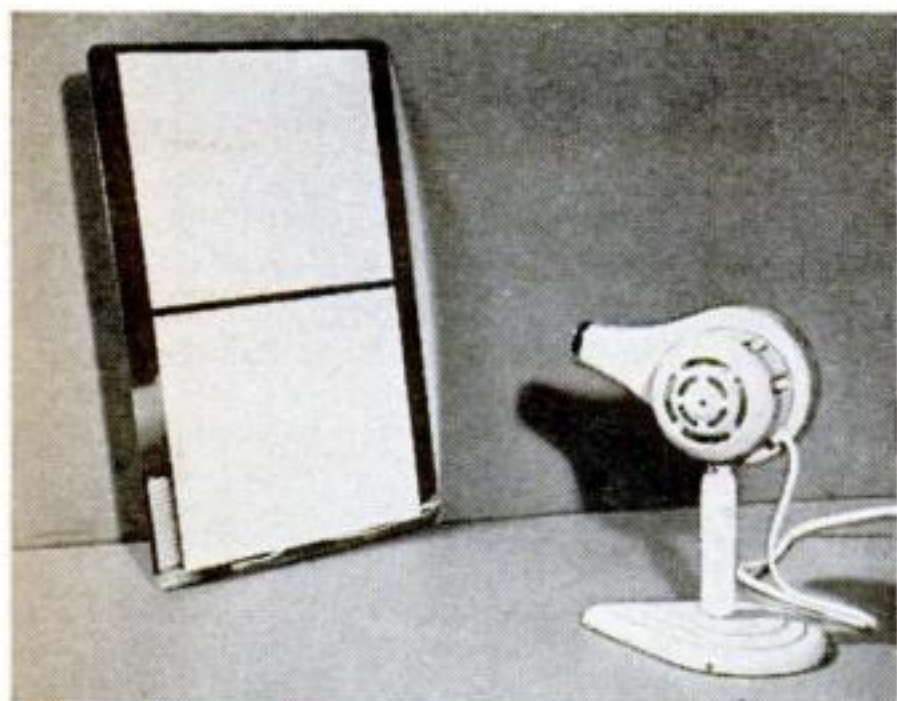
DRY LACQUER on salon prints by directing a flow of warm air over them. A dryer with a separate switch for the heating coil is the most useful type.



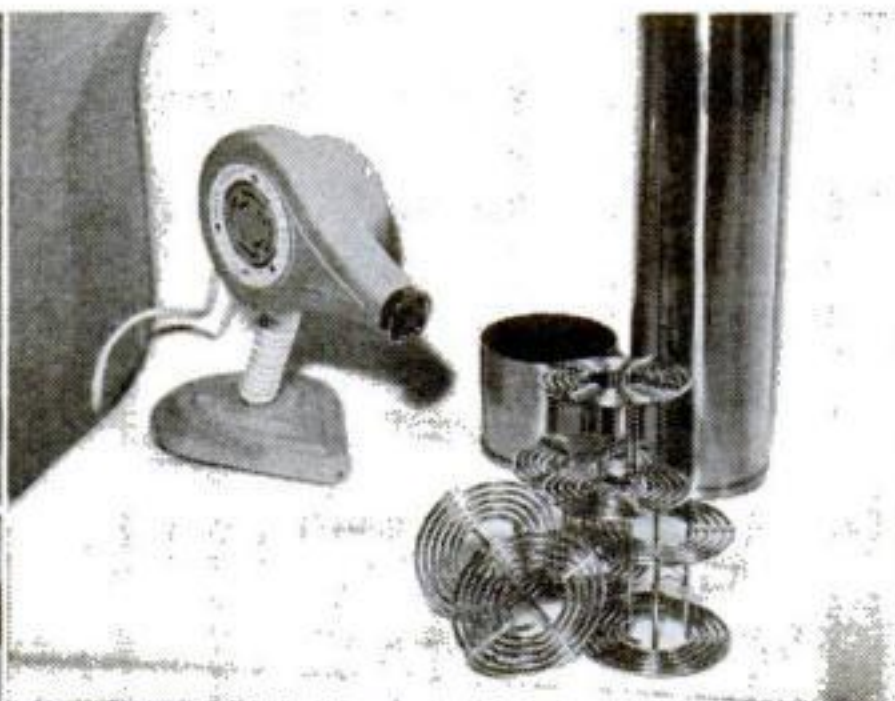
PRINTS IN A BLOTTER dry faster if you use the plastic hood that comes with most dryers. Snap the elastic headpiece over the end of the roll.



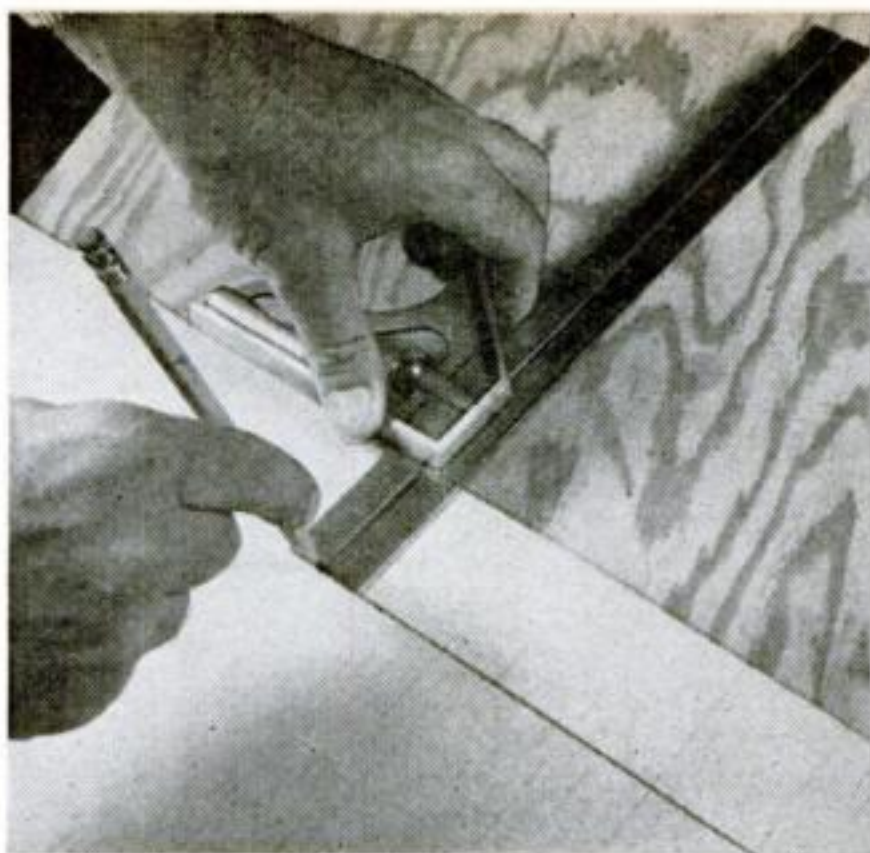
SOLUTIONS TOO COOL? Raise the temperature by directing warm air over the containers. Another use: to exhaust chemical fumes.



DRY FERROTYPED PRINTS FAST. Keep the dryer back far enough for a flow of air over the entire tin. Another use: to dry your damp hands.



DRY REELS and other processing equipment for immediate re-use with a play of warm air. Another use: to blast dust out of cameras.



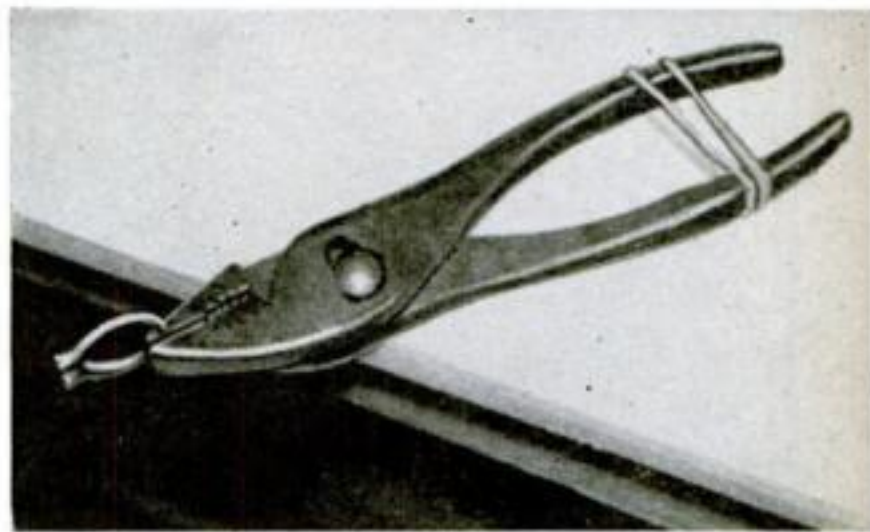
Square as Marking Gauge

FILE a notch at the end of the groove in a combination square and you can use it as a marking gauge. Take the measurement, lock the square, and slide it along the work with a pencil in the notch.—*Darrell Huff, Pacific Grove, Calif.*

▶▶▶SCRAPS left when you put down sheet-vinyl flooring can be cut into a supply of beverage coasters. The material is resistant to heat and liquids, and is easily washed. I cut several large pieces for pitchers.—*J. H. Matthews, St. Louis, Mo.*

Short Cuts and Tips

FROM PS READERS



Tension Vise for Small Parts

WRAP a rubber band around the handles of your pliers to convert them into a tension vise for soldering delicate parts. You won't risk damaging the parts as you would using a regular vise or clamp.—*Harry Wheeler, Toledo, Ohio.*

▶▶▶WHEN you have a number of screw-heads, boltheads, or nailheads to paint, poke them through a piece of heavy cardboard, leaving only the heads exposed. You can spray or brush them all at the same time.—*Henry Mullen, Cleveland.*

My Most Embarrassing Shop Moment

By Floyd N. Jessmore
Saginaw, Mich.

MY YOUNG son likes to go along on hunting trips with me so I bought him a realistic-looking plastic rifle that shoots a cork on a string, enabling him to "play just like Daddy."

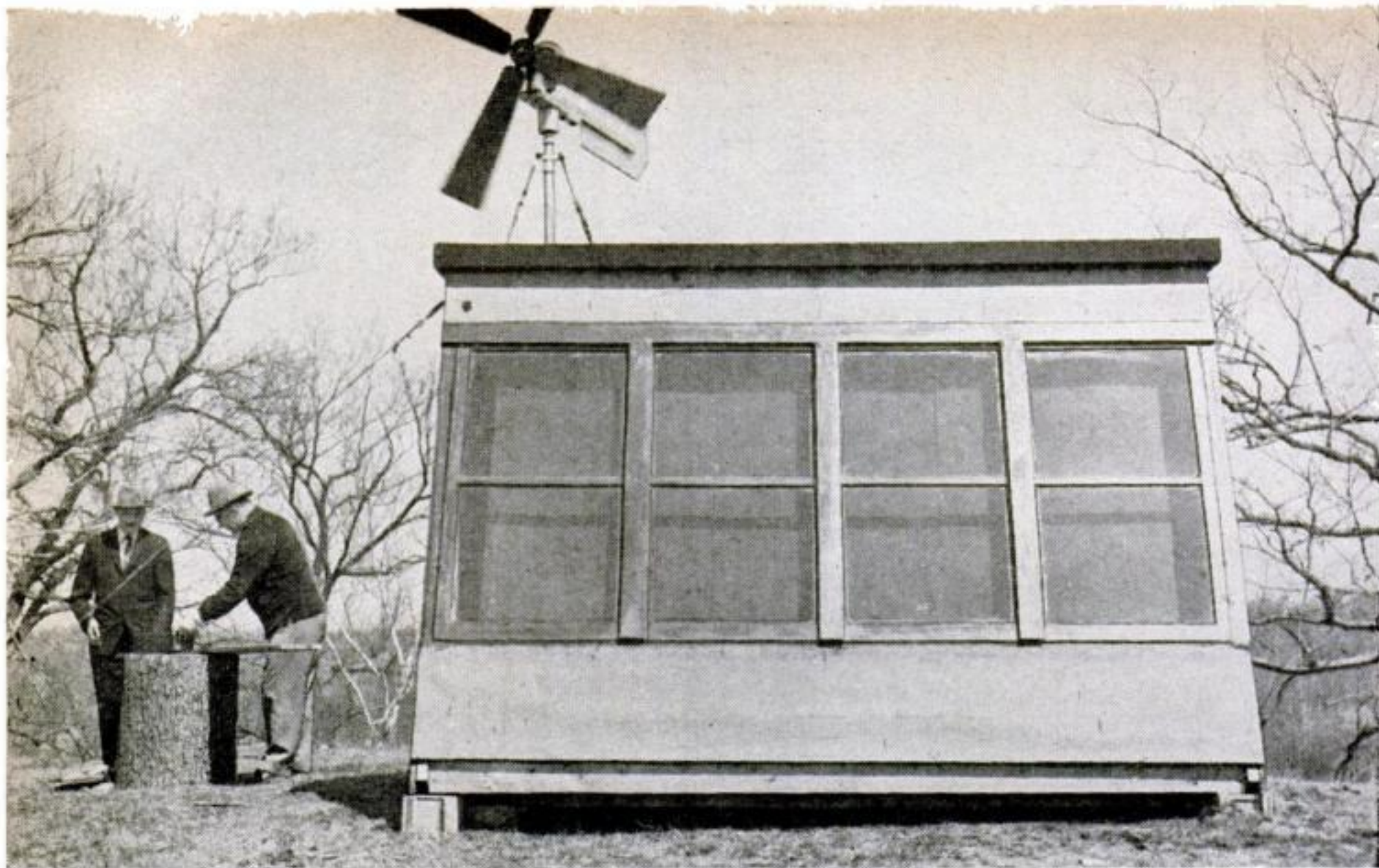
On this particular day, I didn't feel like hunting but agreed to go on a walk with him. As usual, he insisted on bringing along his popgun even though I had left my own gun at home. After a mile or so, he began to tire and asked if I would carry the gun.

As we broke out into a clearing, two hunters approached and asked if I had seen any birds. I told them my dog had flushed a few back a way and I gestured toward the trees with my gun arm.

Suddenly, I saw the men staring at each



other and then at the gun in my hand, with its silly cork dangling from the muzzle. I hurriedly explained—laughingly—that it belonged to my son, but when I turned around, the little devil had run off to play and was nowhere in sight. The hunters retreated in a hurry.



**The heat of the sun and the power of the wind
are now combined in a—**

New Way to Season Lumber

By F. A. Strenge

NEW ideas for trapping the sun's heat are now being coupled with a centuries-old windmill action to season lumber. The new process dries fine cabinet woods faster and more thoroughly than conventional air drying. Results are close to those of a modern kiln.

The wind-powered dryer was developed by Curtis Johnson, a technician at the U. S. Forest Products Laboratory, Madison, Wis. He got the idea from solar drying experiments at the laboratory. Because electricity was not available to run the fan, he fell back on wind power.

A woodworker in his spare time, Johnson wanted a way to dry lumber cut from logs he buys from farmers.

The heart of the dryer is a heat collector that traps the sun's heat. This is

mounted behind glass windows of the south wall at an angle of $22\frac{1}{2}$ degrees from the vertical. The side of the collector facing the sun is 26-gauge galvanized sheet iron painted dull black to absorb maximum heat. The opposite side is closed in with $\frac{1}{8}$ " hardboard except for an opening about a foot high near the bottom.

Air enters the collector through a ventilating slot (screened to keep out rodents) in the floor of the dryer. The air is warmed as it rises to the roof. There, a windmill-driven fan blows the heated air down through the lumber to pick up moisture from the boards. Some of the moisture-laden air escapes through structural leaks or through the ventilating slot in the floor; some re-enters the heat collector.

During 80- or 90-degree weather, Johnson has found that the air temperature in the dryer gets up to 130 or 140 degrees F.



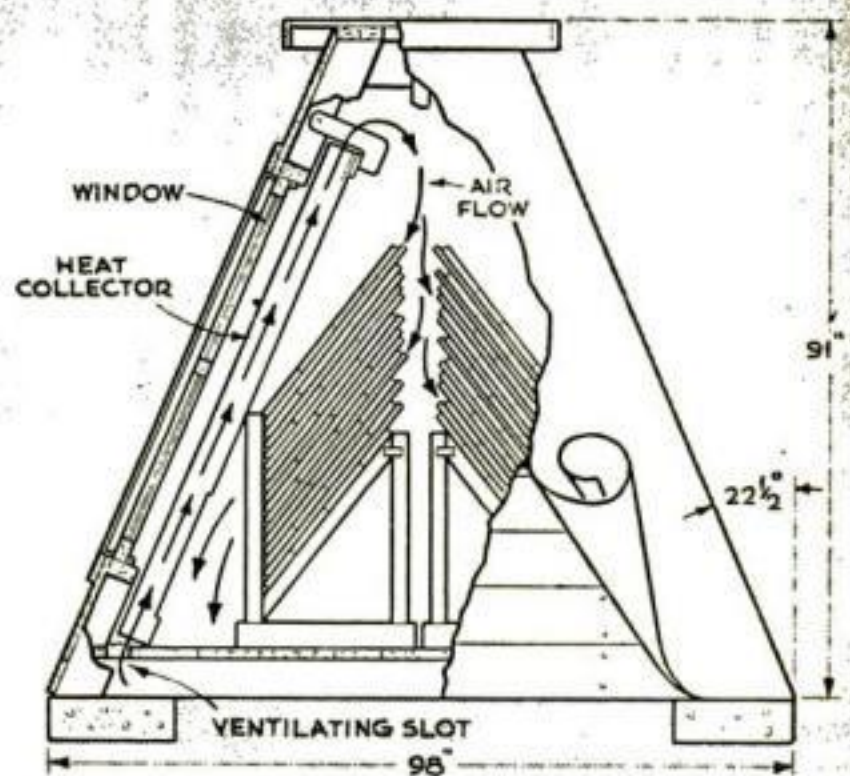
LUMBER-DRYING SHACK built by Forest Products Lab technician has four large windows facing south (left). A large door on the northern side hinges upward for loading and unloading of the rack. A blower powered by the wind sends warm air through the lumber.

Even during the cold months of a typical Wisconsin winter, sunshine will raise the dryer temperature to 90 degrees or higher.

In 52 days from mid-July through early September the dryer brought the moisture content of black cherry boards from 60 percent down to 7 percent, white oak from 16 down to 8. From mid-November to mid-June—mainly poor drying months—cherry came down from 50 to about 8 percent. The lumber in both runs came out bright, clean, and undamaged by seasoning checks (hairlike surface cracks).

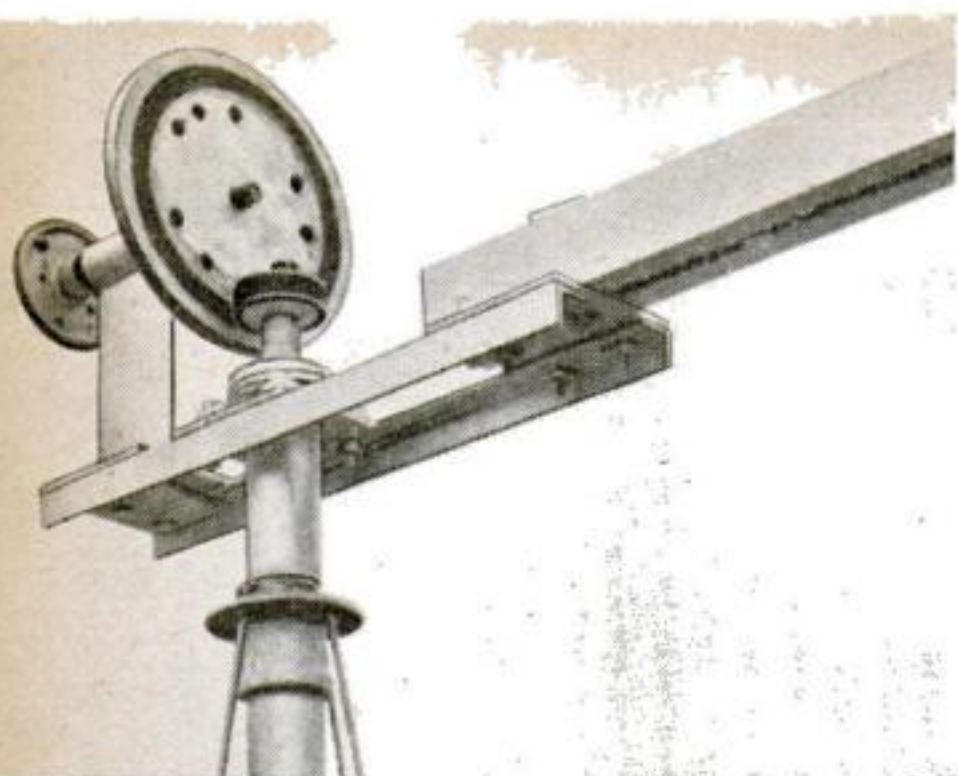
In Wisconsin, air drying would have been much slower and could not have brought the moisture content much below 15 percent. That's considerably higher than that desirable for good furniture, paneling, cabinets, and other items used indoors.

The four blades of Johnson's original 54" windmill wheel were cut from plywood and covered with glass cloth. A plywood vane holds the windmill into the wind.

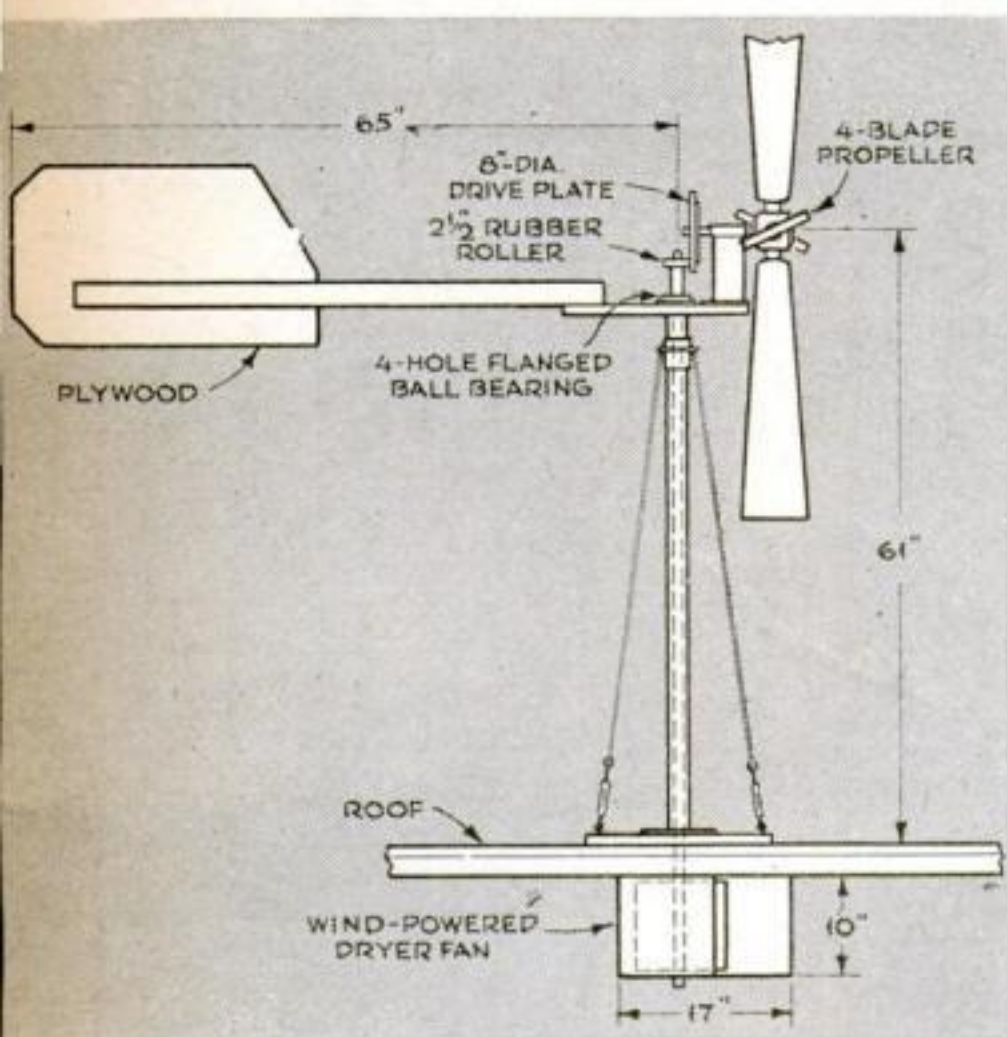


On the driving end of the windmill shaft is a circular friction plate cut from hardboard. This plate turns a roller drive on the fan shaft. The ratio of roller to friction plate triples the speed of the fan shaft over that of the windmill.

Johnson chose this friction drive in preference to gears for two reasons. It was cheaper, and slippage of the friction members absorbs a lot of the jerky effect of wind gusts. A four-mile wind is enough to drive the fan fast enough for a useful rate of air circulation.



HARDBOARD FRICTION PLATE shown above, driven by windmill, turns the rubber roller on the fan shaft. Slight slippage of these driving members absorbs jerks caused by wind gusts.



The dryer structure, about 10' long, is framed with two-by-fours and two-by-sixes, and enclosed with shiplap boards and 36-pound black roofing felt. Oak boards covered with hardboard make the floor. Four storm windows of single-strength glass enclose the south wall. The glass area is about 37 square feet.

Loading and unloading of the dryer is through a doorway in the north wall. The door is hinged at the top, its weight thus helping to seal the edges when it is closed against the sloping wall. In the west wall is a small door through which Johnson can enter to check on drying conditions.

The entire dryer is raised on concrete blocks at the corners to let air circulate in and out.

The dryer holds about 400 board feet of lumber 8' long. The angle at which the boards are piled allows air to circulate downward. Each layer of boards is separated from the next by three strips 1" thick, one at each end of the pile and one in the middle. This is adequate for stiff lumber like cherry and oak. More limber woods such as basswood and aspen need more dividers to prevent warping while they dry—say 2' apart. Johnson dries his lumber rough sawn.

A skilled technician, Johnson scientifically checks the rate at which lumber dries. This involves sample pieces carefully weighed at the beginning of a run. Thereafter he periodically reweighs the samples, the loss in weight indicating how the moisture content is going down.

For other than experimental work, however, Johnson thinks an electric moisture meter is accurate enough to tell you when the lumber is dry. These can sometimes be rented from lumber dealers. For furniture, interior paneling, and the like, lumber should be dried to about eight-percent moisture content, give or take a couple of percentage points, in all but the most humid parts of the U. S. Along the Gulf Coast an 11-percent average is preferred.

If your climate is milder than Wisconsin's, a solar dryer will season lumber faster. Many kinds of wood, moreover, dry faster than oak and cherry. Since there is little or no danger of overdrying in a solar-heated kiln, you can leave the lumber in as long as you wish after the expected drying period has elapsed. Disconnect the windmill wheel or fan.

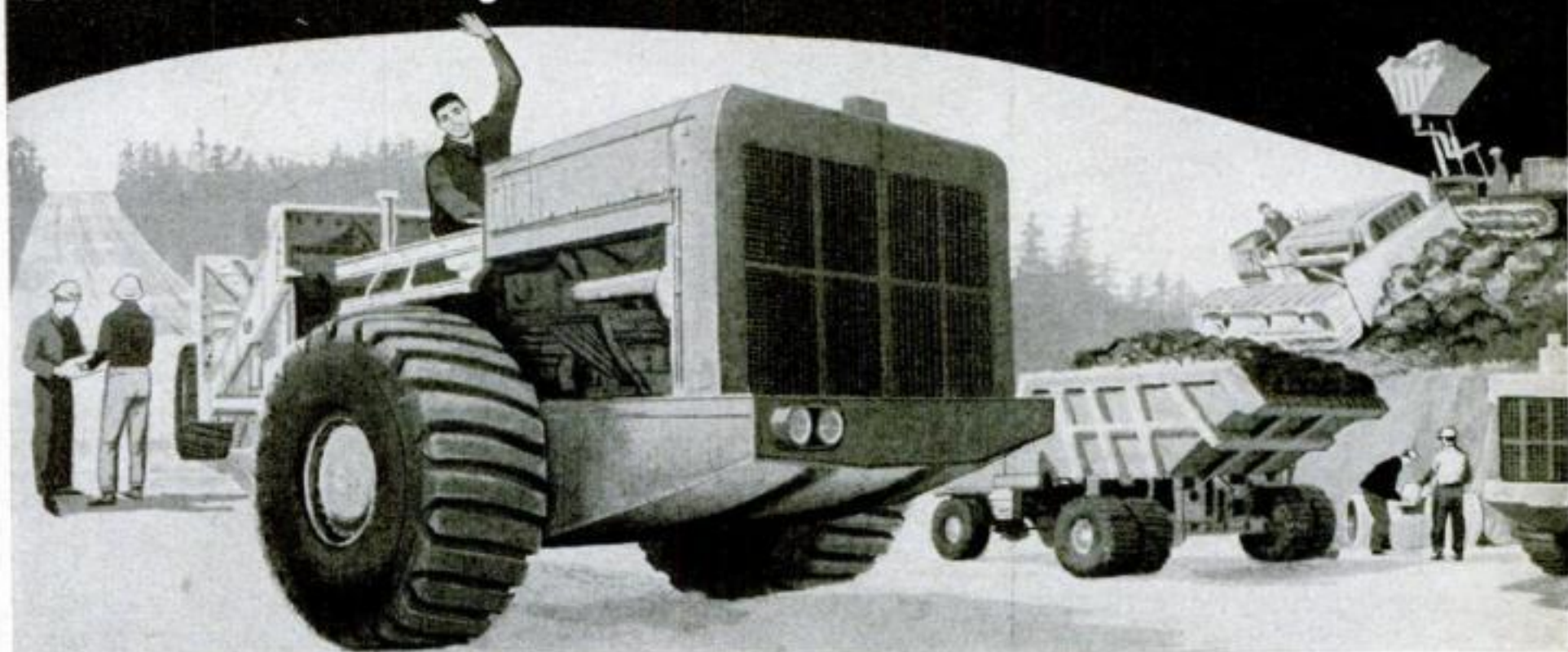
Johnson has found his dryer a paying proposition. He buys logs for 10 cents a board foot of lumber yielded by the saw and sells the seasoned rough lumber for three times that or more—a price that's still cheap. ■ ■

Where to Find Lumber Bargains

Is such a thing possible—in these days of higher and higher prices? Yes, indeed. You buy *green* lumber at rural sawmills. An article in the March issue of *POPULAR SCIENCE* will tell you how to select it—and use it.

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WE OFFER YOU IMMEDIATE TRAINING IN HEAVY EQUIPMENT OPERATION



What you are looking at are the wonder tools of a new age, mechanical monsters that are changing the face of the world we live in. The BULL DOZER... the LOADER... the GRADER... the EARTH-MOVER—these have made possible today's complex civilization. But as mighty as they are these giants are lifeless without the men to operate them. Only under the guidance of a man's hand can these machines throw bridges over wide rivers, create dams to turn wasteland into lush fields, ribbon the broad face of our country with super-highways. Only because there are men at the controls are schools, factories, office buildings, hospitals reaching toward the sky.

This is an industry which is spending billions of dollars—yet even as it builds it is unable to meet the demand. This is an industry which is charged with supplying facilities for the explosive increase in population—here and all over the world. This is an industry which offers bright futures to MEN! And these men must come from somewhere!

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But there is one thing that is vitally necessary: You must have a sincere interest in heavy equipment operation. These announcements are interesting men all over the country and thousands are writing in. Our representatives simply do not have time to visit those who are merely curious. They ask you for no obligation or commitment except this: *You must have a serious interest.* Whether or not you later decide to go ahead is strictly up to you.

The man who will call on you will help you. He will explain to you the future of heavy equipment operation: You can make up your mind from what you learn from him whether heavy equipment training is for you. To many men—men like you—the Northwest representative was an enormously important visitor. He may be the same for you.

The men in enviable heavy equipment careers took that first step... to get TRAINING. *The next step is yours.* Get information about age and other requirements which must be met to qualify for employment in this giant industry. Fill in the card facing this page and drop it in the mail. No stamp is needed... we pay the postage. Then the next move will be ours. Good luck to you.

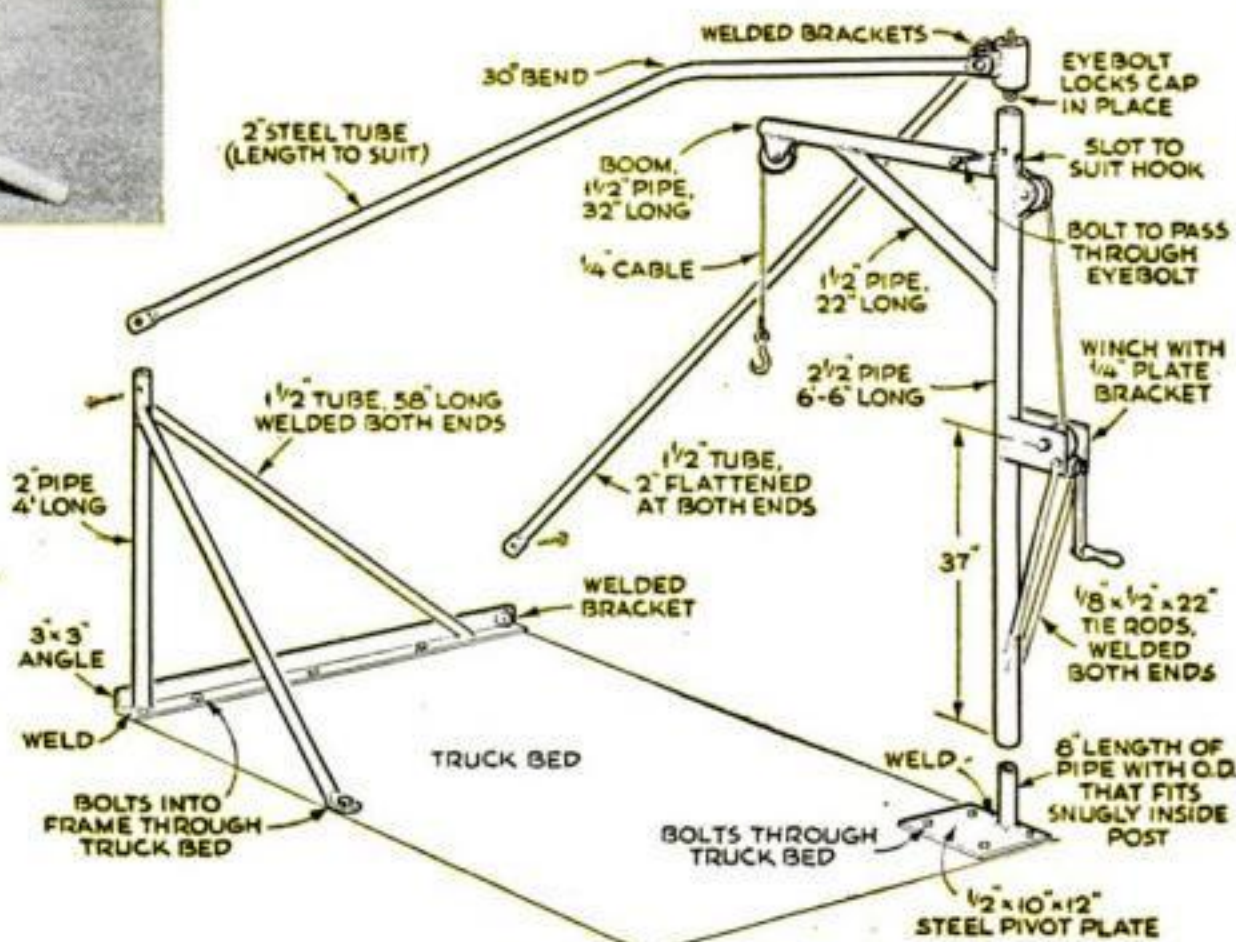
DON'T DELAY. To learn about this training without obligation, use the postage paid card facing this announcement. If someone has already used the card, just write a note to HEAVY EQUIPMENT TRAINING, DEPT. B-39, NORTHWEST SCHOOLS, 730 THIRD AVENUE, NEW YORK 17, N.Y. Give your name, address, age, nearest phone, working hours. You will get full information.



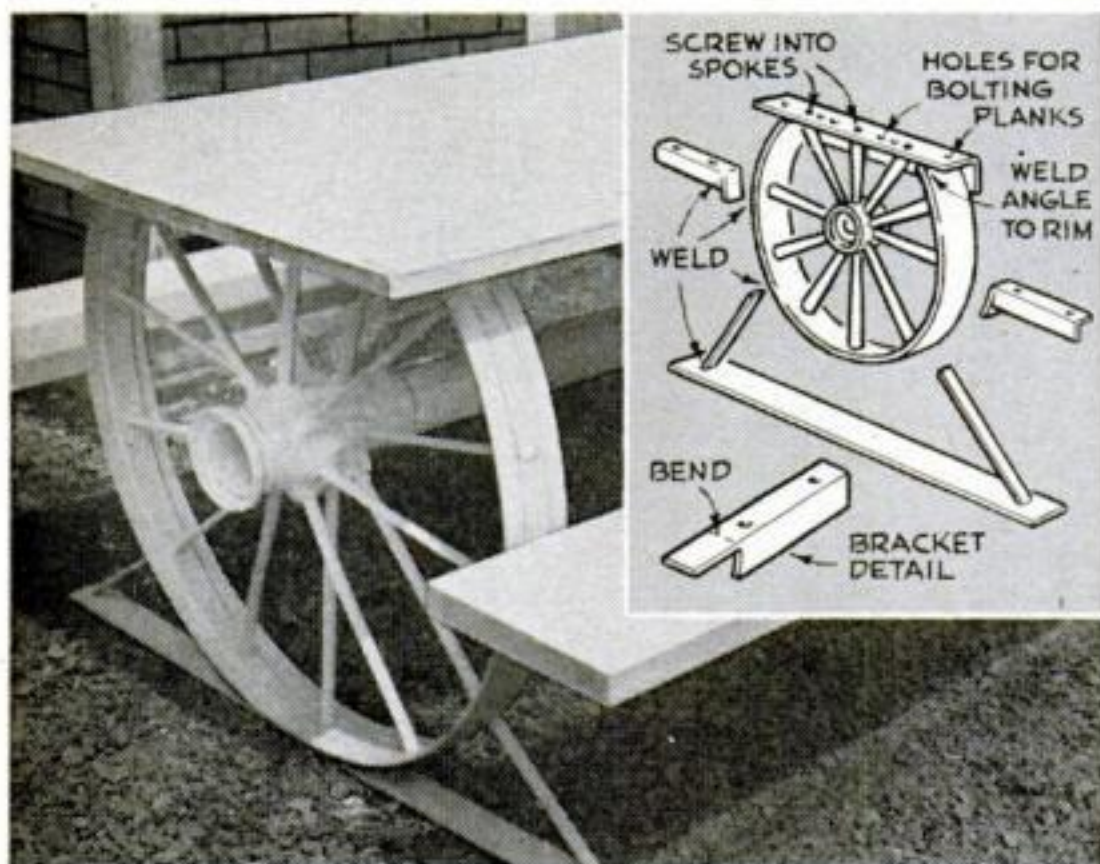
A swivel hoist for a pick-up truck makes one-man loading a cinch. You just swing the boom out over the tailgate, then pivot it back over the truck bed when you have cranked the load high enough to clear. The boom post and its braces can be removed after you unload, as in the photo above.

I can load 1,600 pounds of oil drums (with the accessory on the next page) in about 10 minutes—with no helper and no back strain. I've cranked a 700-pound hand

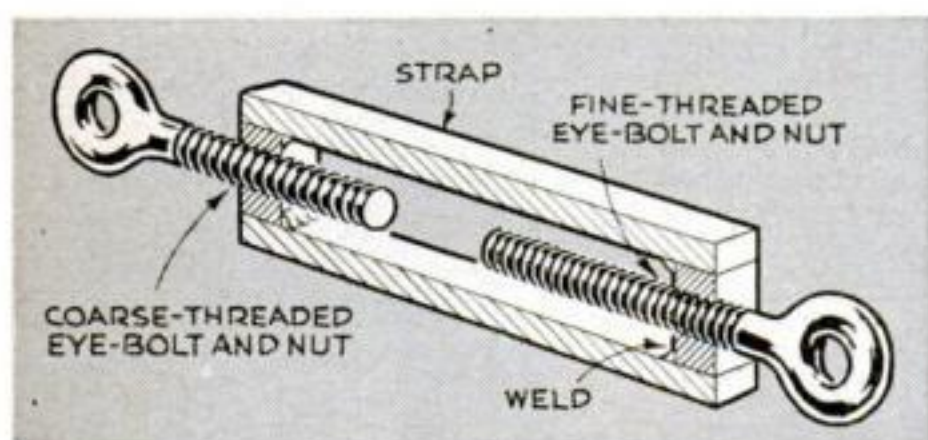
For the



brake aboard, too. For my winch, I got a surplus bomb-bay hoist from a nearby Army depot. It's done double duty sev-

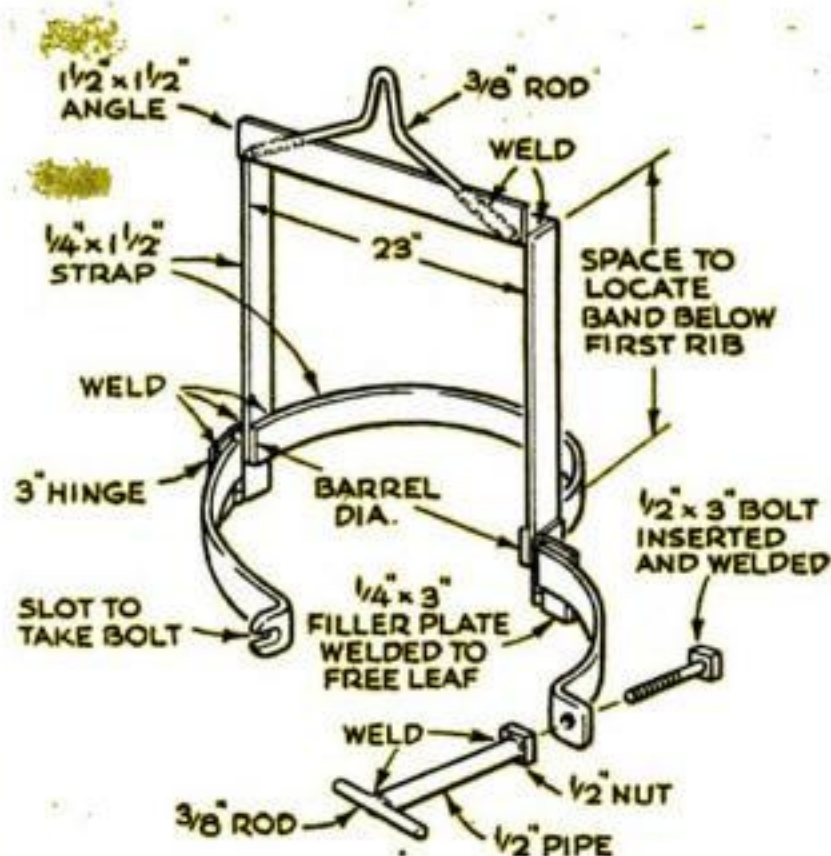


Wagon-wheel picnic tables are made by blacksmith "Buck" Burkhardt of Hecker, Ill. He cuts off the top of each wheel at table height and welds on an angle to which the fir or redwood planks can be bolted. Strap-iron runners and bases are welded to the bottom of the rim, with seat brackets attached at each side. Any pair of flat-rim wheels will do. If the spokes are metal, as in the photo, weld the cut ones to the top angle; if wood, secure them as shown in the sketch. A salvageable axle is left intact or hollow pipe is substituted.—Grover Brinkman, Okawville, Ill.



You can improvise a turnbuckle for emergency use—and you needn't own a set of left-hand taps. Two methods are shown in cross section. The secret of both is the difference in rate of take-up between coarse- and fine-threaded bolts. When either turnbuckle is turned clockwise, it moves ahead on both bolts. But the difference in the threads causes the

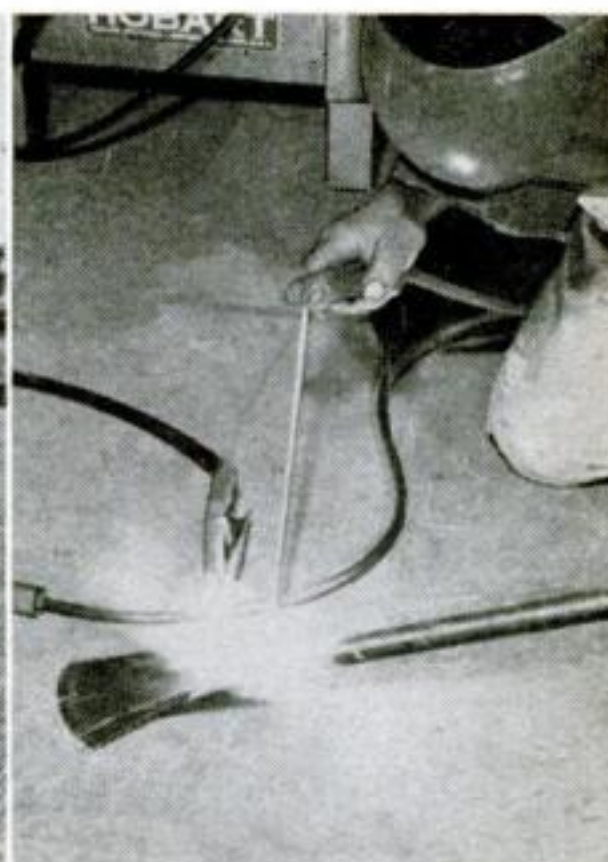
Man Who Can Weld



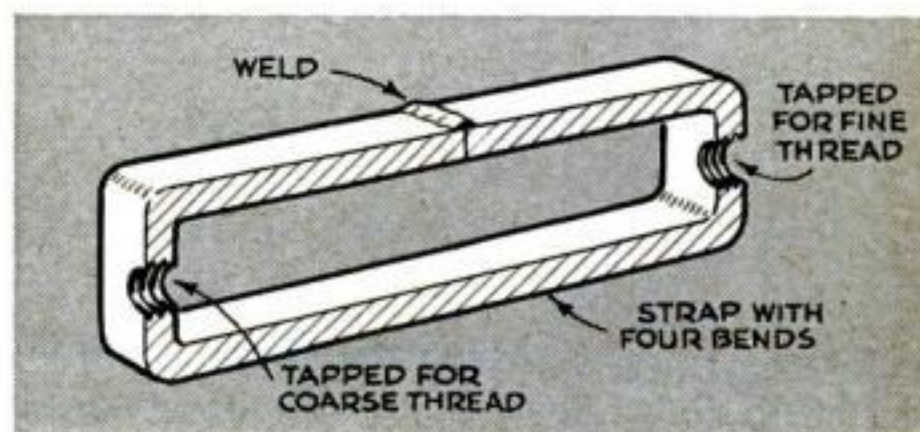
eral times, pulling cars out of the mud. As a companion piece, the handle for steel barrels (right) makes it easy for one man to hoist heavy drums. Clamp the open bracket around the drum, with the

hinged band below a rib, and snap it shut, seating the bolt projecting from one lip into the slot of the other. The nut wrench draws the band snug.—D. A. Lathrop, Saguaro Nat'l Monument, Ariz.

A straight-stroke axe is handy for chopping roots in close quarters—as under bushes or low branches—where swinging a regular axe can be hazardous. It's fine, too, for digging up stumps and dislodging rocks. The trick: Weld an old axe head onto a length of iron pipe. Use the longest piece and largest diameter consistent with easy handling; the heavier the tool the deeper the blade will bite. For a handgrip, screw on a pipe T.—V. Lee Oertle, Glendora, Calif.



system to gain a little more than it loses. It won't take up as fast as a conventional turnbuckle, but you can speed the action by using a larger-diameter coarse-threaded bolt. This system can be valuable for precision control: It permits micro adjustments not possible with conventional turnbuckles.—William B. Rasmussen, Prosser, Wash.

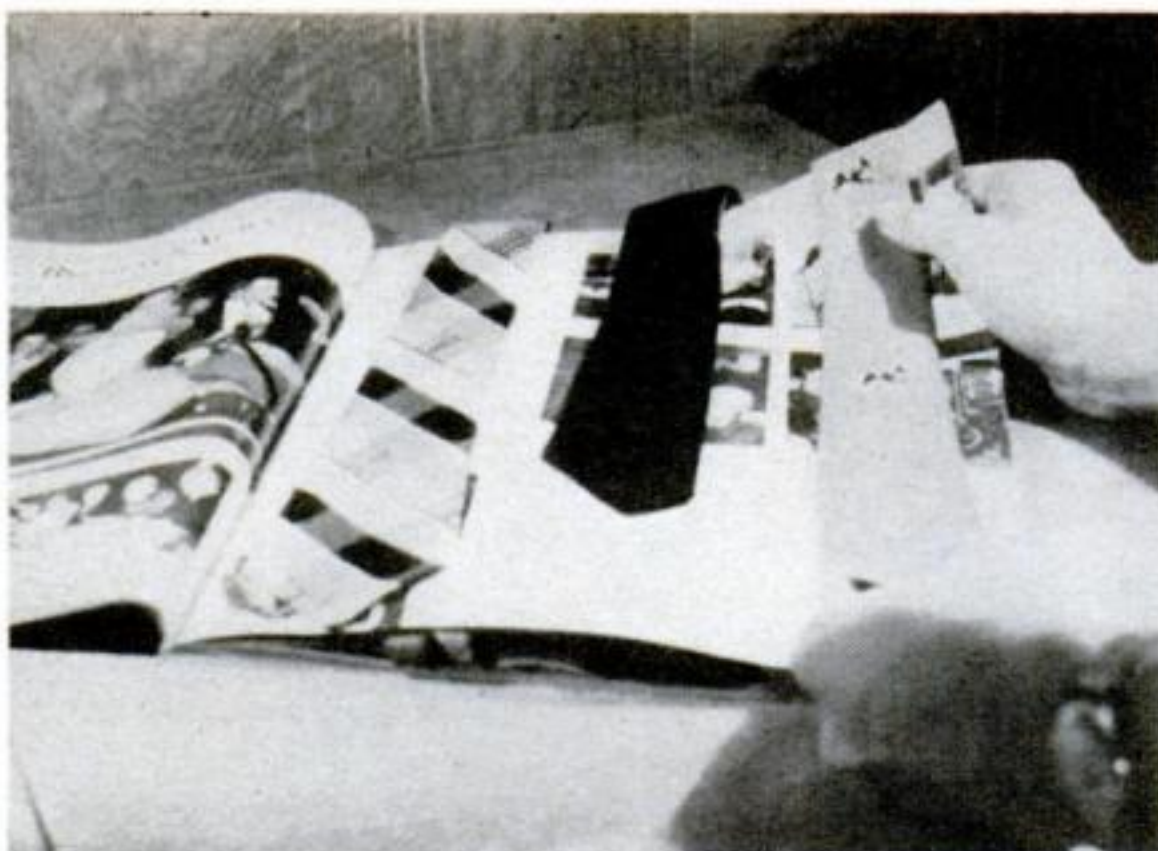


Short Cuts and Tips

FROM PS READERS

Travel Tip for Wrinkle-Free Ties

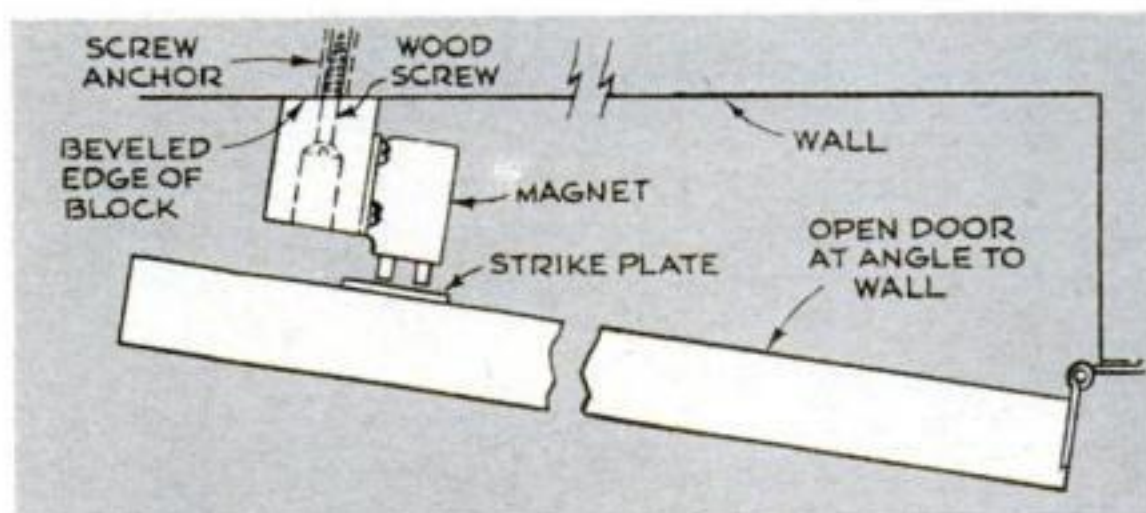
TO PACK neckties flat in the bottom of a suitcase, weave them through a magazine, as at right. Lay them on one page and fold them back and forth three or four times, leaving a few pages between layers—*Steven R. Scadding, Toronto.*



Magnetic Catch Replaces Door Stop

TIRED of fidgeting with hooks or wedge-type door stops to keep inside doors open? An inexpensive magnetic cupboard catch will hold against drafts, yet release at a tug.

Since such catches are designed for undershelf mounting, you'll need a wood block or angle bracket to attach one to the wall or trim. Mount it above head height. If the door doesn't swing back parallel to the wall, bend the bracket or bevel the



block so the magnet faces the door squarely. If the catch doesn't hold securely, the plate is striking only one pole of the magnet; readjust the angle.—*Harry Walton, White Plains, N.Y.*

..... WHAT'S YOUR MECHANICAL IQ?

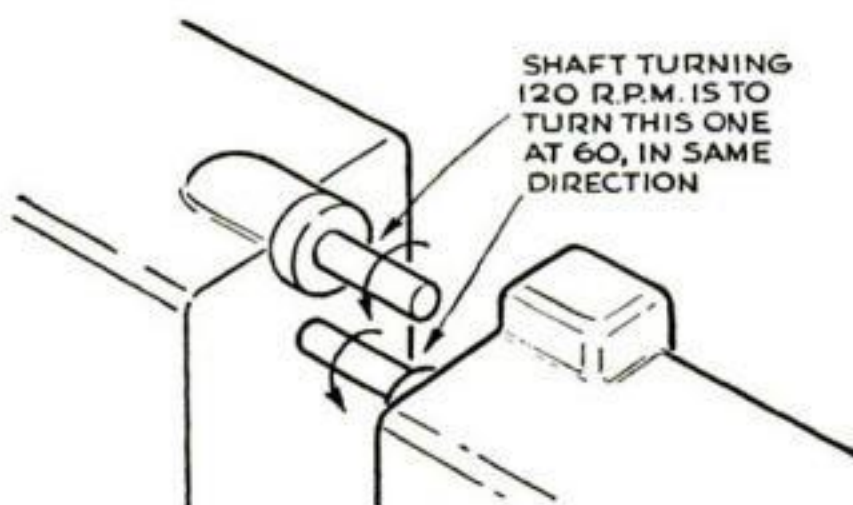
The Case of the Gearless Reduction Drive

"THAT company engineer is passing through here tomorrow and wants to see my invention!" groaned Elmer, folding the telegram he'd just read.

"Isn't that good?" asked Frank.

"No, he's early—and tomorrow's Sunday. This shaft, turning at 120 r.p.m., must drive the other one, without slip, at 60—and in the same direction. That takes an idler gear. I can't get three gears of the right size and ratio on a Saturday night."

"No, but you can make a gearless 2:1 reduction to fit your shaft spacing, and



both shafts will turn the same way. You'll need some bar and angle stock, a faceplate, and two ball bearings."

"Those I've got. Show me."

Under Frank's guidance, Elmer had the shafts coupled and the invention working before the church bells sounded.

How did he do it?

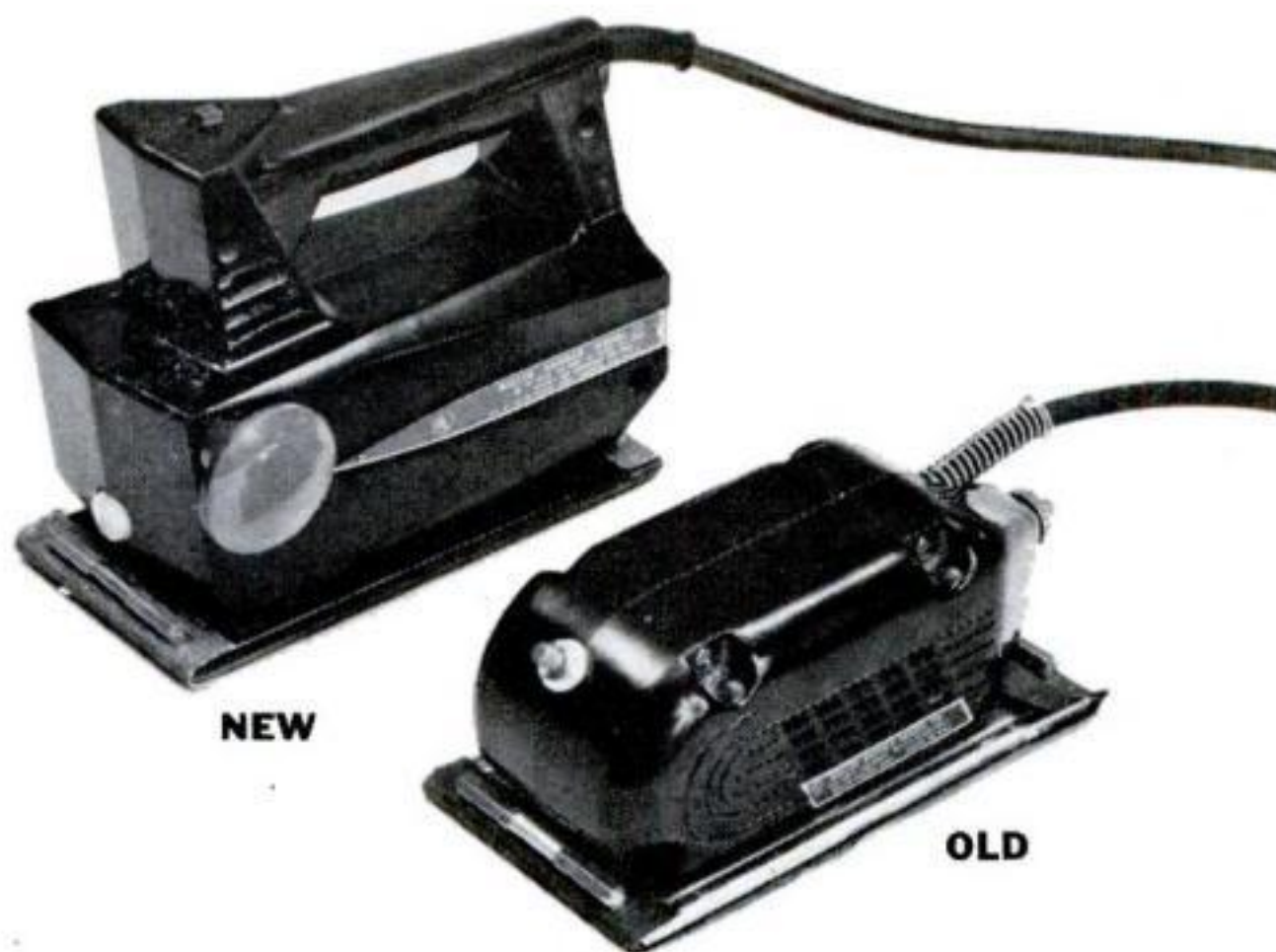
Answer on page 198

HOME SHOP news report

By Sheldon M. Gallager

For fine finishing: a brand-new sander from Weller. Those who have a fondness for the famous little hand-held Weller sander introduced in 1955 are in for good news: There's a powerful new model. Outwardly, it's slightly bigger, smartly styled, and, for the first time, sports a handle on top.

But the big difference is under the hood. Power comes from the same high-speed reciprocating vibrator with the same whopping 14,400 strokes a minute. The coil has been beefed up,



however, to draw 4.8 amps—almost double the original 2.9. The drive has been revamped, too. In the original Weller Model 700, the moving armature was linked directly to the sanding plate. In the new Model 77, a lever drives the plate, lengthening the sanding stroke from $3/32''$ to $5/32''$. Sanding-plate area has also been upped a bit to 26 sq. in. from 25. An ingenious vibrating vane cools the coil like a lady's fan since there's no rotary motion for a regular fan blade. (The earlier model didn't have a fan.) Add them all up and you have tremendous new sanding power.

At the same time, the new Weller gives you the same super-smooth finish that has made its predecessor a favorite of many professional and home wood finishers for years. Its secret is the short, straight, back-and-forth stroke. This lets you sand with the grain without scarring the wood. Price: \$19.95 (against \$13.48 for the old model). The new model will be available at hardware stores or from Weller Electric Corp., 601 Stone's Crossing Rd., Easton, Pa.

CONTINUED

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Home shop news report continued

How the sanders compare. To test cutting speed, each tool was timed to see how long it took to sand out a 1/16"-deep saw kerf in identical 4"-by-5" blocks of pine and maple. The small block was chosen deliberately to force each sander to remove an equal amount, not just dig a narrow depression in a large board. An orbital sander and 5" disk sander, though not true finishing tools, were included for comparison. All used No. 1/0 (80) open-coat aluminum oxide paper. The score:

	IN PINE	IN MAPLE
Orig. Weller	8 min., 18 sec.	22 min., 30 sec.
New Weller	3 min., 10 sec.	6 min., 25 sec.
Orbital	2 min., 28 sec.	8 min., 10 sec.
5" disk	58 sec.	2 min., 15 sec.

Here's the big surprise. In softwood, the orbital outcuts both Wellers. But in hardwood, the new Weller actually outcuts the orbital. This is important, since most fine finishing is done on hardwood. Note also that the new Weller far outcuts the old on both hardwood and softwood.

How tough is it really? Finishing sanders aren't supposed to be any great shakes on difficult jobs like removing paint or smoothing end grain. To check the tools out, each was required to remove age-hardened enamel from identical 4"-by-5" blocks, and to smooth rough-sawed ends on one-by-four pine. No. 3/0 (120) was used here to simulate actual practice, since you wouldn't coarse-sand a fine old antique. The results:

	REMOVING PAINT	SMOOTHING END GRAIN
Orig. Weller	3 min.	40 sec.
New Weller	58 sec.	18 sec.
Orbital	62 sec.	15 sec.

You can see that the orbital is a bit faster on end grain, the new Weller a bit faster on paint removal. Both are fine tools, depending on your needs. The Wellers have one advantage: Unlike the orbital, they can sand right up to walls and into corners because their short stroke is not hampered by obstructions. With 3/0 paper, the new model removed paint from a 5"-square corner area in 2 minutes, the older model in 2½.

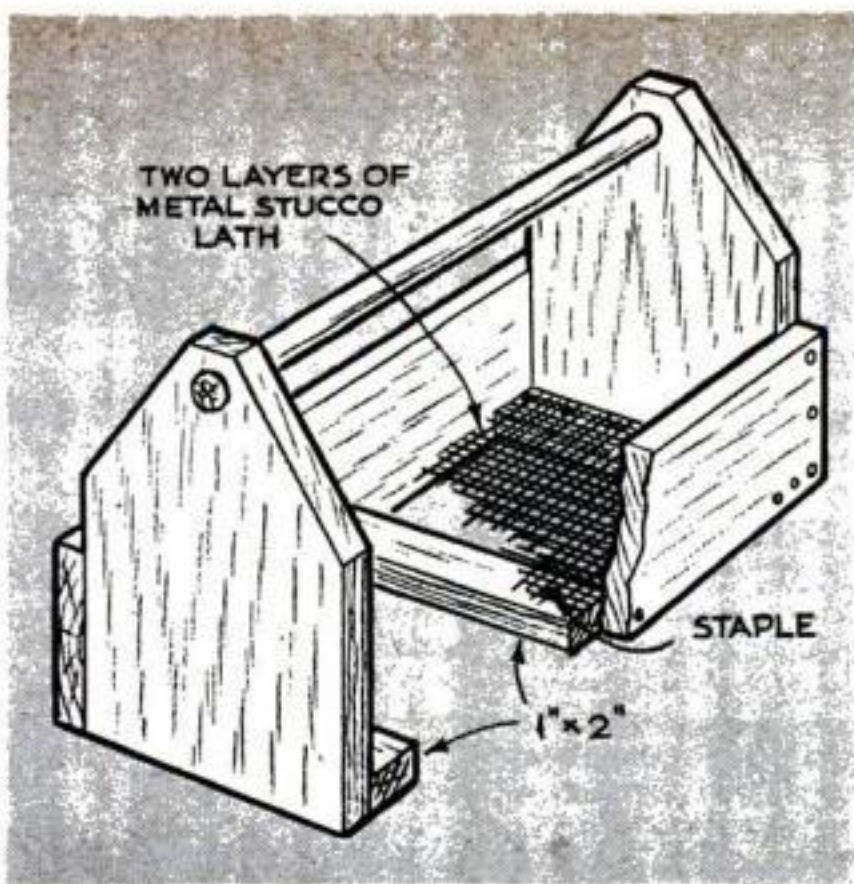
Tests were also made on plywood edges—another tough job. After one minute with 6/0 (220) paper, both samples were smooth. But the Weller's proved finer and more polished than the orbital's. The orbital, however, has an advantage here: Its two-way cutting action levels all plies equally. The Weller's straight-line action tends to leave the hard end-grain plies a bit higher than the soft with-grain ones.

Tips on using the new tool. While with-grain sanding is smoothest for fine finishing, you'll go faster across the grain for rough stock removal. The 3 minutes, 10 seconds clocked for the grooved-block test jumped to 4½ minutes when tried with the grain. Another interesting discovery: While open-coat papers are recommended for less clogging, the Weller's rapid action shakes loose sanding dust so well that you can use closed-coat papers

[Continued on page 232]

Short Cuts and Tips

FROM PS READERS



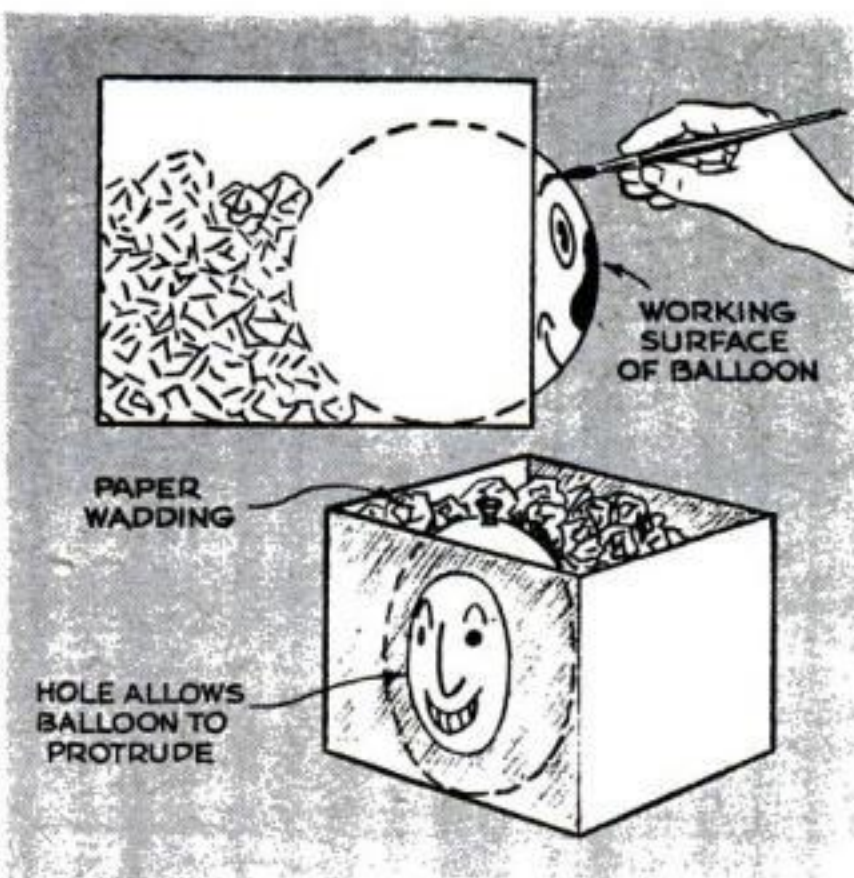
Self-Cleaning Toolbox

INSTEAD of solid wood, I used a double layer of metal stucco lath for the bottom of my toolbox. I stapled it on and reinforced it with one-by-two cross slats. Sawdust and wood chips fall through. —Uosis Juodvalkis, Indiana Harbor, Ind.



Replacing Paint-Can Lids

SUREST way to reseal the disk-type lid of a paint can: Snug it on first, then slip the can sideways into your vise for a quick turn that seats the lid firmly and evenly, with no air leaks to cause skin-over. —Jackson Hand, Westport, Conn.



Easel for Decorating Balloons

A BALLOON must be inflated while you paint or ink on decorations or lettering. But it's hard to keep it still. A simple holder can be made from a cardboard box a little larger than the balloon. Cut a window in one side (the shape determined by that of the balloon) to let a section of the balloon protrude. Place wadded paper in back to hold the balloon forward. —W. C. Wilhite, Carlinville, Ill.

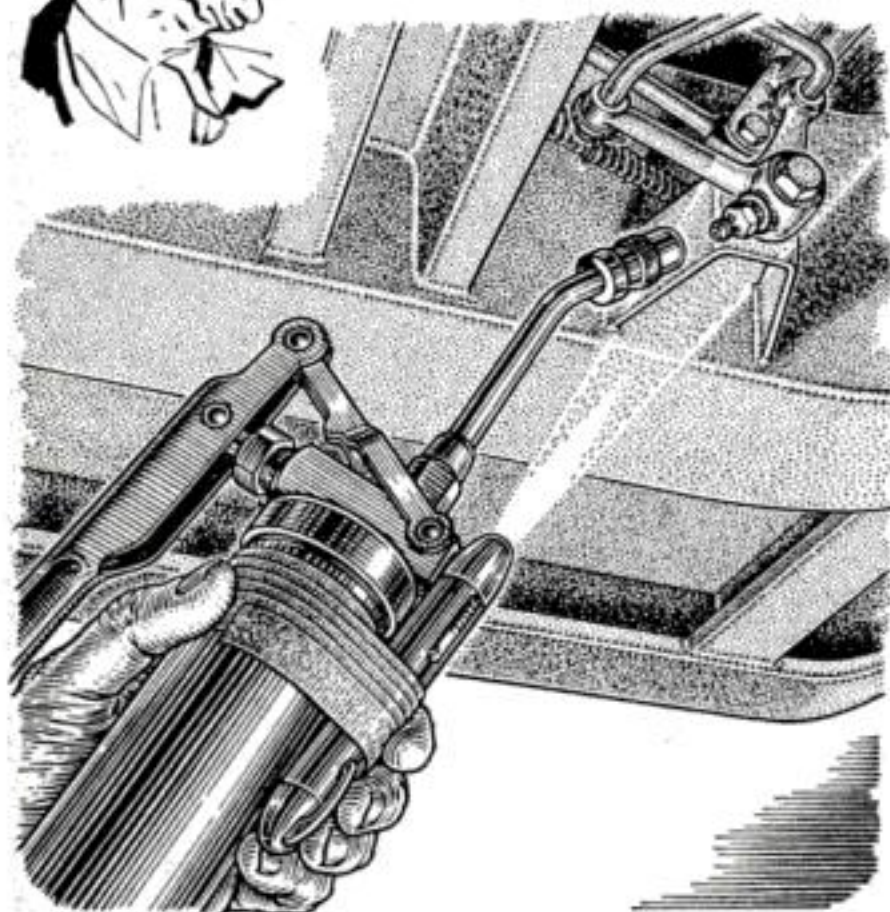


Pulling Nails from Molding

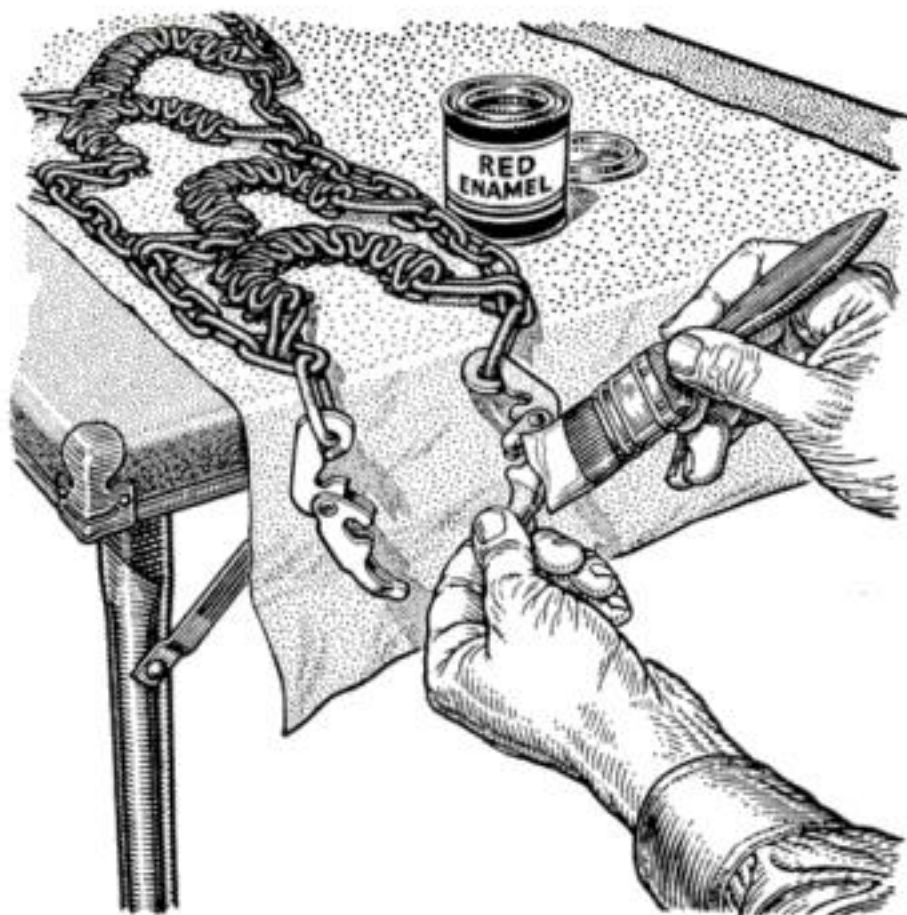
EVERYBODY says that to salvage a piece of molding or trim you've removed, you should pull brads out the back so you won't mar the finish side. But nobody tells you *how*. I've found that the best method is to fit the claw of a hammer or wrenching bar around a nail, grip the nail with cutting pliers, and pry. Nail heads will pull through $\frac{3}{4}$ " hardwood. —Richard Maine, No. Stonington, Conn.



Hints from the Model Garage



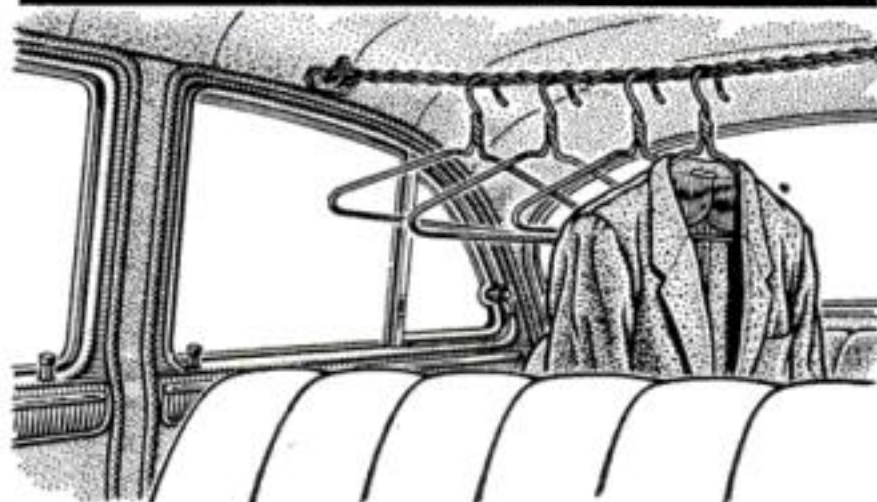
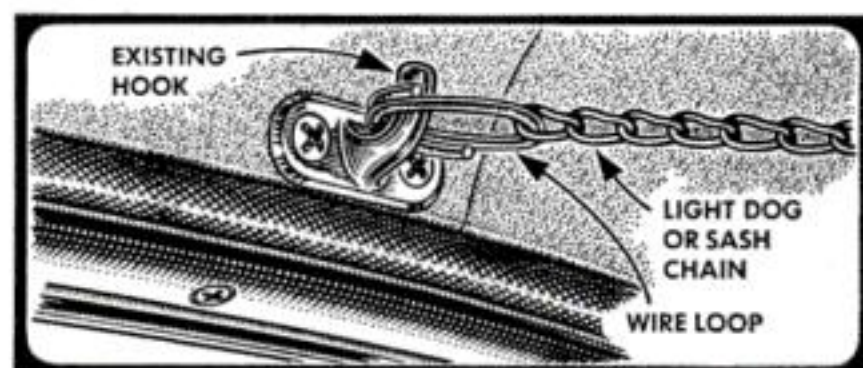
For chassis lubrication, a pen flashlight securely taped to the barrel of a grease gun is handier than an extension trouble light. Just locate each grease fitting with the concentrated beam of light and you're automatically on the target.



Storing snow chains in a car trunk soon turns them into a jumble of intertwined links. Mounting them on your tires can be made much easier if you identify the connecting links by painting them red or some other bright color.



Stop lights glow brighter with the help of Christmas-tree reflectors. Slip the base of the bulb through the reflector and mount it in the light socket. The reflector may have to be trimmed to fit inside some of the smaller tail lenses.



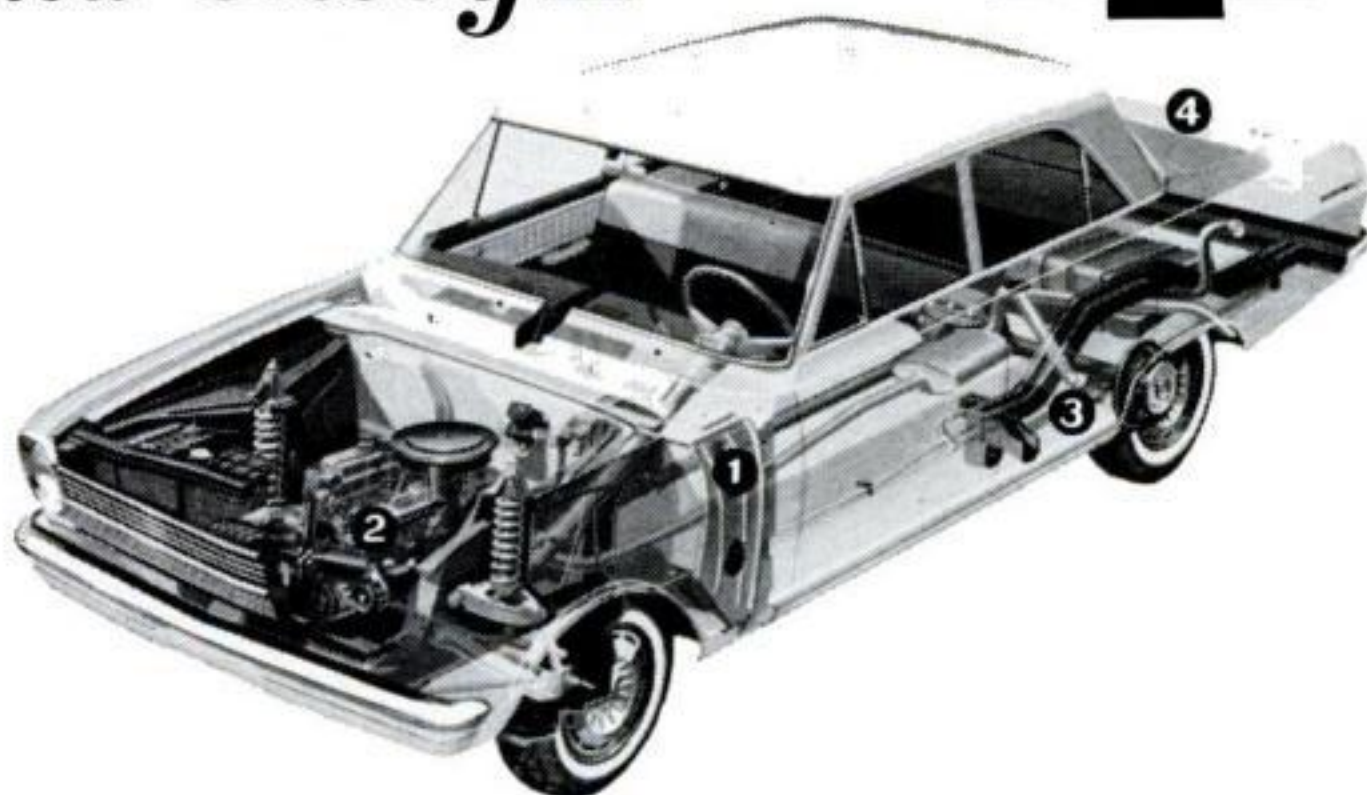
An auto clothes hanger that stretches the width of your car can be made with a few feet of dog or sash chain. Secure it to clothes hooks above the rear windows with wire loops. Coat-hanger hooks slip into the links so clothes can't slide.



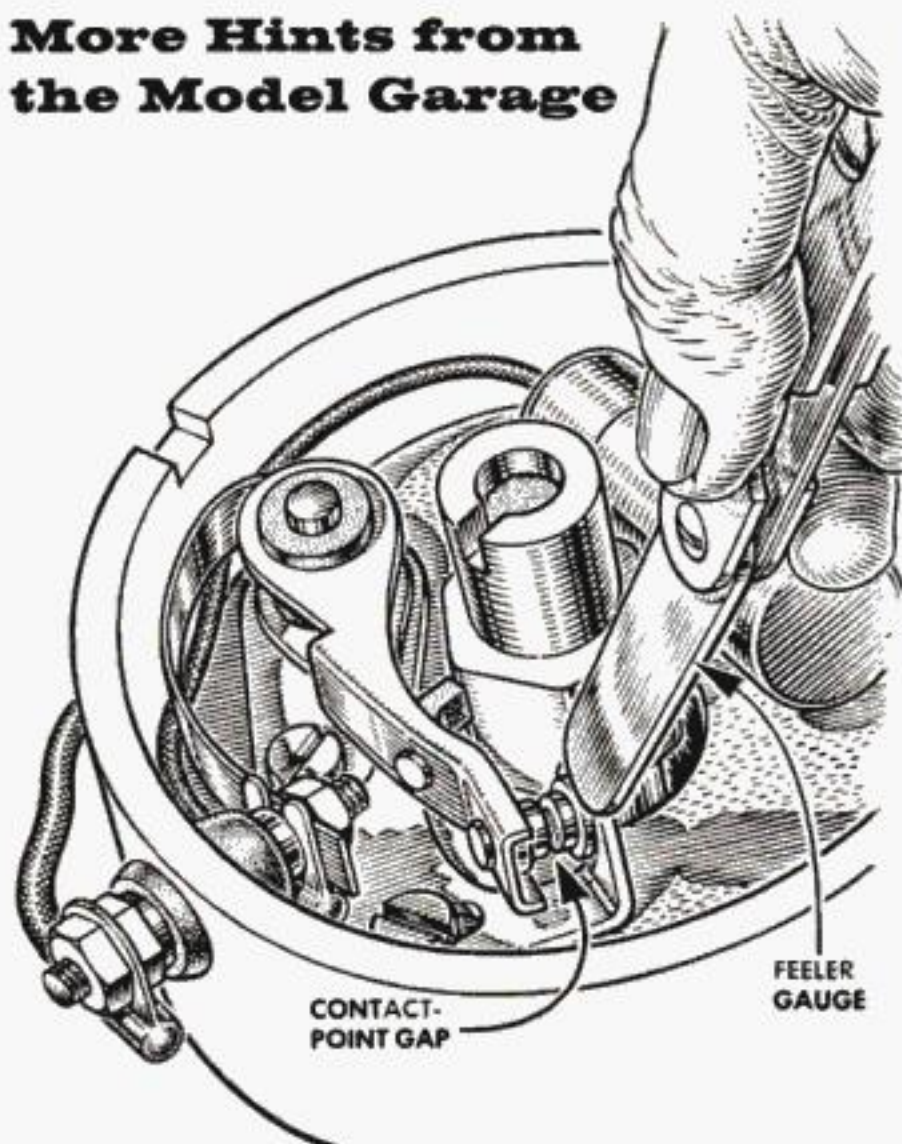
The more savvy you have about cars the more you'll appreciate how we built this one No nonsense here. Just refreshingly honest simplicity—like this:

- ❶ The unique unitized body-frame is designed for long life and low maintenance. Major front-end components, including fenders, are of bolt-on design for easy replacement.
- ❷ The engines (choice of a 4 or a 6 in most models) are short-stroke, large-bore design. The 90-hp 4 has *five* main bearings for long-lived smoothness. The 120-hp 6 has *seven*.
- ❸ The sturdy, easy-riding Mono-Plate rear springs were made possible by breakthroughs in metallurgy and manufacturing. They eliminate the friction and squeaks of multi-leaf springs.
- ❹ From the 25.5-cu.-ft. trunk right on, space is used to your advantage. The Chevy II wheelbase is 110"; its overall length, 183" (187.4" in wagons); its weight, about 2,500 pounds. There are eleven models, including a convertible, sedans, a coupe and wagons. Without unnecessary frills or floss, they are practical, durable and (don't you agree?) nice to look at. More facts? See your dealer. . . . Chevrolet Division of General Motors, Detroit 2, Mich.

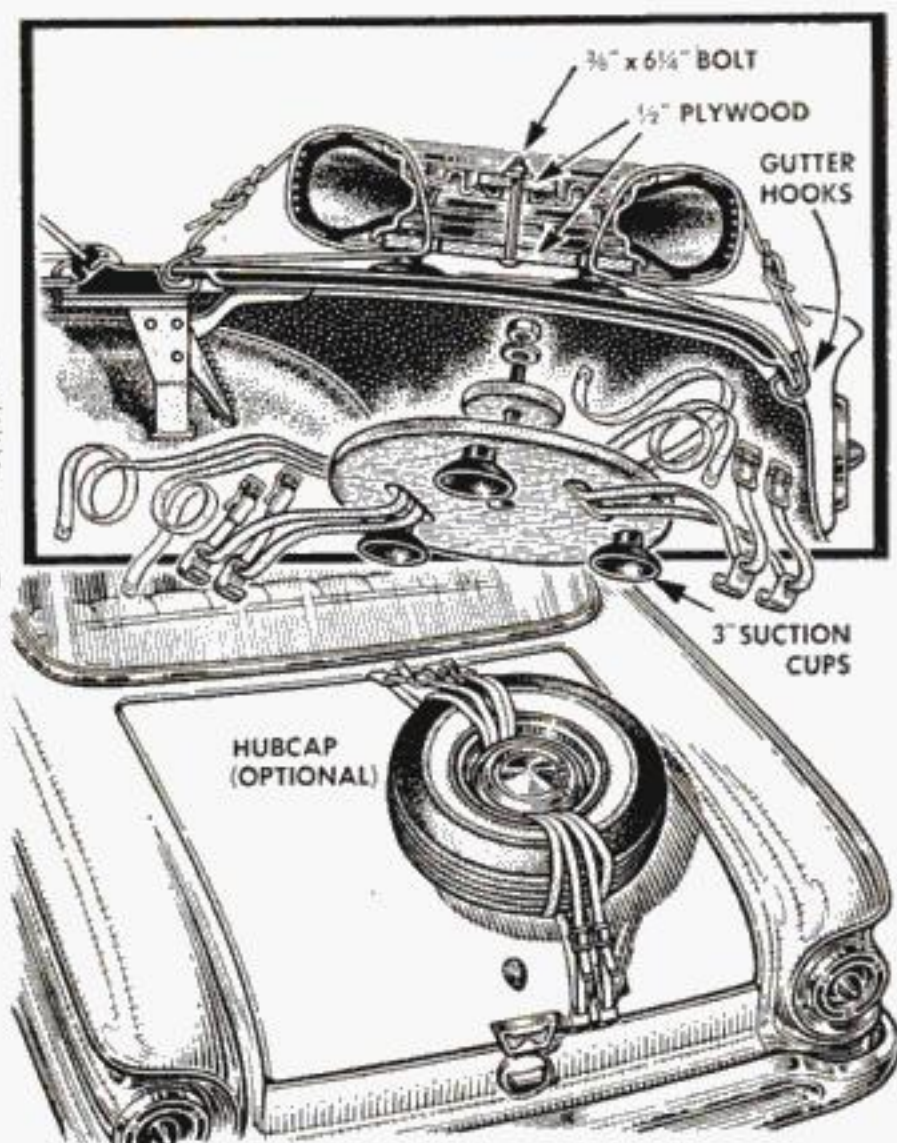
new Chevy II



More Hints from the Model Garage



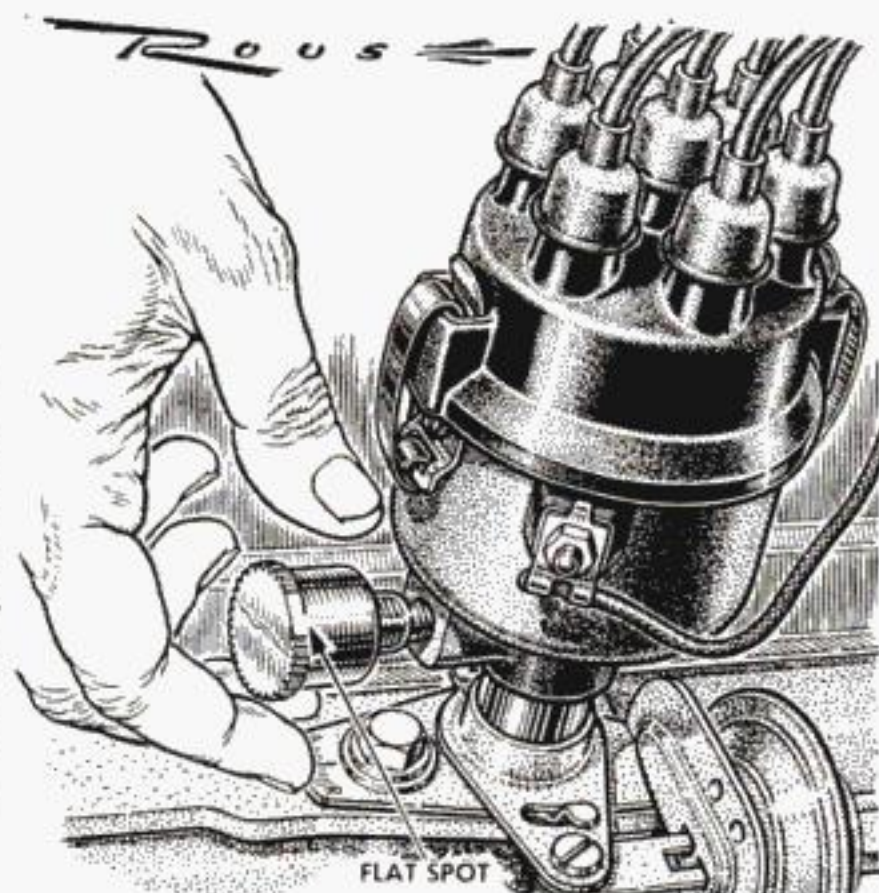
When setting distributor points, check gap on *all* cam high spots. To test for worn distributor cam, time engine, shut it off, reconnect timing light to last cylinder. Timing mark should align with pointer, as it did on Number 1 plug.



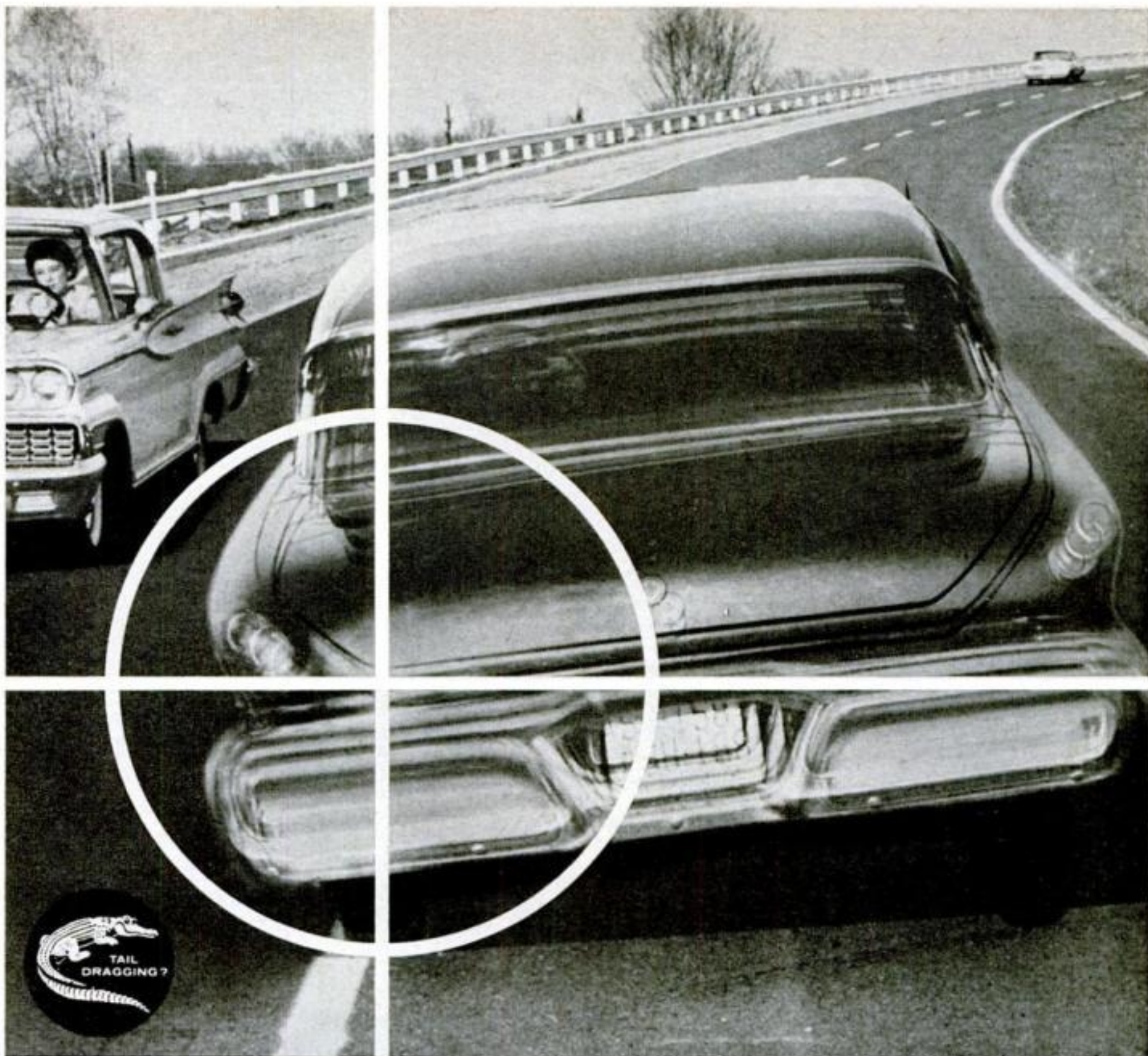
This deck-top spare-tire holder is ideal when every bit of trunk space is needed for vacation luggage. Double web straps pass through wheel slits, securing the wheel. Plywood backing plate has three big suction cups so finish isn't marred.



An invisible crack in a rear-axle shaft can be detected without fancy equipment. Clean the shaft with solvent, wipe dry, and hang it up with wire. Then tap with a hammer to expel solvent and oil—and pinpoint the crack.



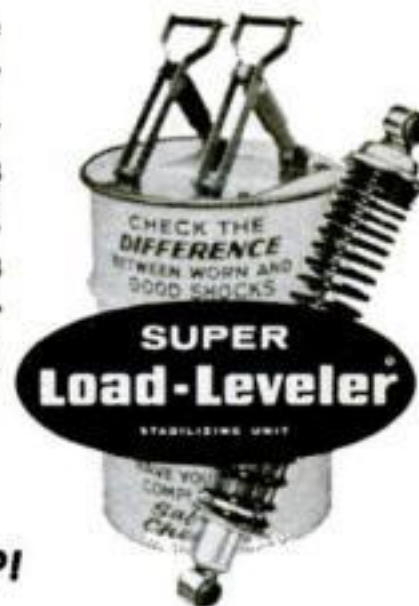
The grease cup provided on some cars to lubricate the distributor shaft must be turned periodically. Though easy to reach, the cup is hard to see. By filing a flat spot on it, you can feel each complete turn and insure proper lubrication.



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Gus Loses a Customer



By Martin Bunn

"EMERGENCY? Sure it's an emergency. I got 15 machines to service," crackled an agitated voice on the phone.

"Okay. Where do I go?" asked Gus.

"I'm leaving Humbert's now. I'm parked on a hill so I can roll down to start. Meet me at National Drugs—and be sure to bring that new Bendix drive."

Slightly mystified, Gus drove the Model Garage service truck to the drug-company parking lot. A hard-used sedan with the legend "Vend-a-Cup" on its battered sides was there—locked. He sounded his horn. A white-jacketed fig-

ure ran out of the nearest building.

He was a slight man with a snub nose that gave him the appearance of a harried small boy. A grin split his freckled face as he dropped two enormous ham-pers to shake hands.

"Name's Jim Melchin. I run a string of coffee, candy, and sandwich machines."

"So that's it. I wondered what you meant by having 15 to service."

"Gotta be dependable. Slack off, and you lose your machine locations to the syndicate."

Having loaded sandwiches from the car into one hamper, Melchin thrust a



"It's too hot to touch," Gus said. "I'll pull the wheel; it may cool faster."

bunch of keys at Gus. "Try the starter. Then put in that new Bendix. I've got to be on my way when I've serviced these machines."

Gus found that the starter whirled energetically but did not engage the engine. He proceeded to remove the starter, which on this car could be done from above.

The drive wasn't gummed or jammed; its pinion ran freely up the shaft thread. The helical spring was intact. The pinion teeth were a bit chipped, but not enough to prevent meshing. More likely, Gus thought, a few flywheel teeth were

missing. But his fingers in the starter opening felt teeth in position to mesh with the pinion.

"Be down in eight minutes!" Melchin's high, urgent voice came from an upper window. Gus nodded, gave up any idea of checking further.

Knocking out the retaining pin, he removed the drive and installed a new one. With the starter back in place, the engine promptly cranked and fired.

"Quick work!" Melchin opened a clinking leather bag. "Hope you don't mind being paid in silver. That's the kind of money I take in."

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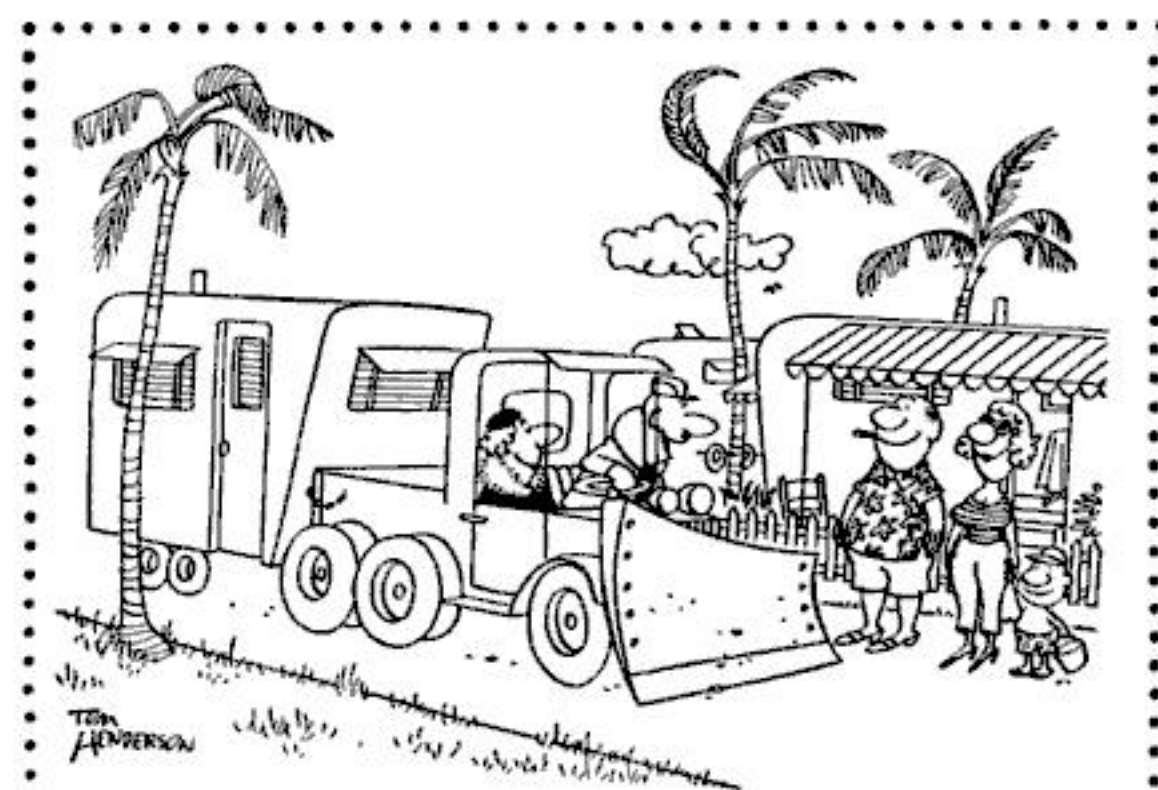
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Gus wrote a receipt for a modest charge and received a fistful of coins. Melchin got behind the wheel.

"I'd like to check the flywheel gear," said Gus. "If it's damaged, the same thing could happen again."

"Might. This is the second new Bendix drive I've had. But I can't spare the bus now—not with the syndicate after my locations."

ABOUT two weeks later State Police Trooper Jerry Corcoran stopped at the Model Garage for a generator check.



"We made very good time all the way down."

"Caught the syndicate yet, Jerry?" asked Gus banteringly.

"Syndicate? How did you know?"

Gus's grin faded. "It's a gag, Jerry." He explained about Melchin's vending route. Jerry laughed.

"That's competition. No law against it yet, and I don't know of any syndicate in that business. No, it's the old numbers racket we're after."

"Thought that was big-city stuff."

"It's moved out. A few employees in big offices and plants here sell the slips on the side. But we haven't spotted the collectors who work for the ring, picking up bets and cash."

"This morning we got a tip from a man at a boat yard. He says the collector drives a Merc station wagon. Yesterday he skidded into a sand hole back of the yard, spun his right wheel trying to get out, then suddenly quit and walked away. An hour later a wrecker came and hauled

the car off. But nobody knows where.

"That's all we can get out of our informer. He clammed up. We'll stake out the place, of course."

"If the car was damaged," said Gus, "they may be using another one. Enough sand in the brake drum could lock the wheel. Keep trying to pull out, with the other wheel on firm ground, and you can break an axle."

Corcoran nodded. "Worth checking garages for a job on a Merc axle?"

Gus shook his head. "Axles break so seldom nowadays they aren't often stocked. The car may be under wraps waiting for a new one from Detroit."

LATER that day Melchin's dusty sedan pulled in. The little man looked morose.

"More starting trouble?" asked Gus.

Melchin nodded. "Same one. You may as well check the flywheel gear. Lost so many locations to the syndicate that I can do my route in half a day."

He sat down, munching one of his chocolate bars, while Gus pulled off the starter. Its pinion teeth were covered with chips,

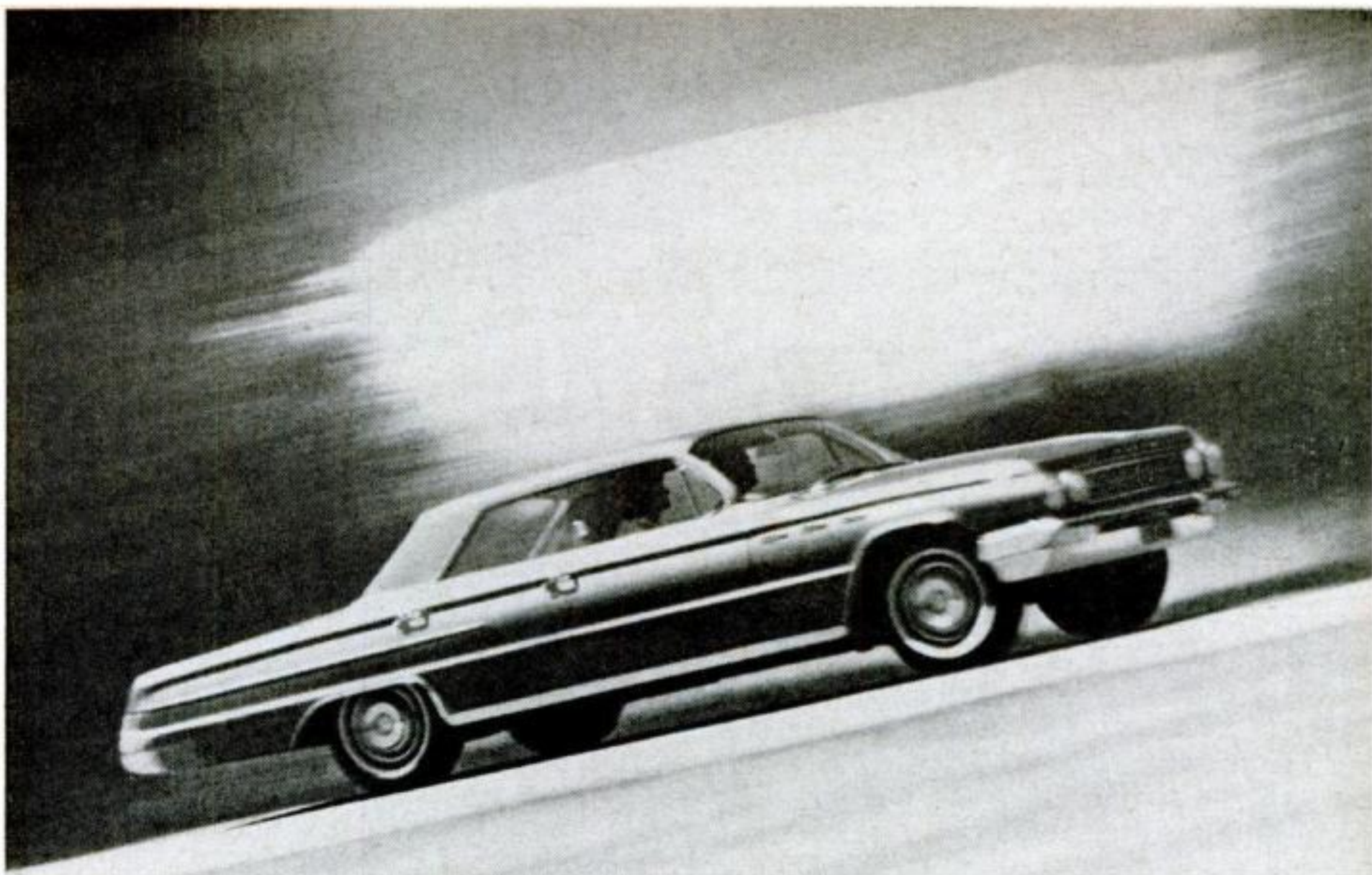
but not, Gus saw, from the teeth themselves. He put the car on a lift, took down the flywheel housing, and called Melchin to look.

"There's your trouble—a soft ring gear. See how all the teeth are chewed down at this end? Each time you put on a new Bendix, its unworn teeth, a shade longer than the old ones, would catch what was left of these, until it again wore them out of mesh."

"Aren't flywheel teeth hardened?"

"Supposed to be. Guess somebody goofed and a batch came through soft. We'll put a hard-toothed flywheel on."

STAN HICKS, Gus's assistant, was doing just that when a big station wagon, trailing the odor of hot steel and burned brake lining, screeched into the shop. As Gus walked over, a hatless young man with glossy hair and a leather coat leaped out.



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response and return. Less road shock up the steering column. Flatter cornering because the front-end frame has been made wider. And, with the engine moved forward, the front floor's gone nearly flat.

WHY YOU'LL LOVE IT: Advanced Thrust makes your driving safer, smoother, more relaxed. Your Buick stays right on course—even in gustiest crosswinds. Going is surer on ice, snow, wet roads. And with the new flatter floor, middle passengers have more room for legs, knees and feet. Feel the *big* difference in the '62 cars—drive the Advanced Thrust '62 Buick. Now at your Buick dealer's. Buick Motor Division — Gen-
eral Motors.

'62 BUICK

"Gus Wilson? I've heard you're pretty good. Let's see how fast you can fix that draggin' brake."

The car was a '59 Merc, its load hidden under canvas. The heat from the right-rear brake drum was so intense it could be felt feet away.

"It's too hot to touch," Gus said. "I'll pull the wheel; it may cool faster."

Gus removed the wheel, noticing that the axle nut showed shiny rounding spots, as if turned with a slightly too large wrench.

The drum was still warm when Gus took it off. Marks on the brake-shoe anchor bolts suggested recent removal. Both drum and lining were ruined.

The driver looked at them and swore. "Okay, get with it. Put in new ones."

Gus mounted a new drum on the hub. With relined shoes in place, he flexed the return springs which, hooked across the two shoes, pull them away from the drum surface when brakes are released. As if accidentally, he dropped a spring on the concrete floor. Then he put both in and finished the job.

With the car on the jack, he put it in gear, spun the wheel, braked it to a stop a few times, checked to see that it still turned freely.

"What's the tab?" asked the man.

Gus told him. "Give it a road test, to see if it still drags."

"If it does," said the driver, handing Gus the cash, "I'll be back."

The moment the car roared out, Gus headed for the phone.

"**WE** PICKED him up a block away," Corcoran told Gus an hour later. "He was headed back here—with a smoking wheel."

"I thought he would be," said Gus.

"In the car," said the trooper, "we

found policy slips, sandwiches, coffee supplies, candy—and this."

He showed Gus a sign of the kind that can be hung on a car window.

"Vending, Inc. That syndicate *was* in the coffee-and-sandwich business. No wonder your friend was frozen out. Servicing the machines daily made a good cover for collecting. The fellow we caught was switched to another route today. That's why our stake-out failed. But he's talking. Now that we know how to spot the collectors, they'll lead us to the big fish."

"So a snapped axle was their Waterloo."

Jerry nodded. "This chap did snap an axle in that sand hole. The ring's mechanic got a used one and put it in. But when the brake dragged, he was too far from home base, so he came to you. Says he watched you do all the right things—even check it on a jack—and can't figure why it still grabbed. What gimmicked it?"

"The return springs," said Gus. "Running hot in the sand took the temper out of them. I dropped one and it sounded like a lead nickel. Their man replaced the shoes but not the springs. So I left 'em in, too."

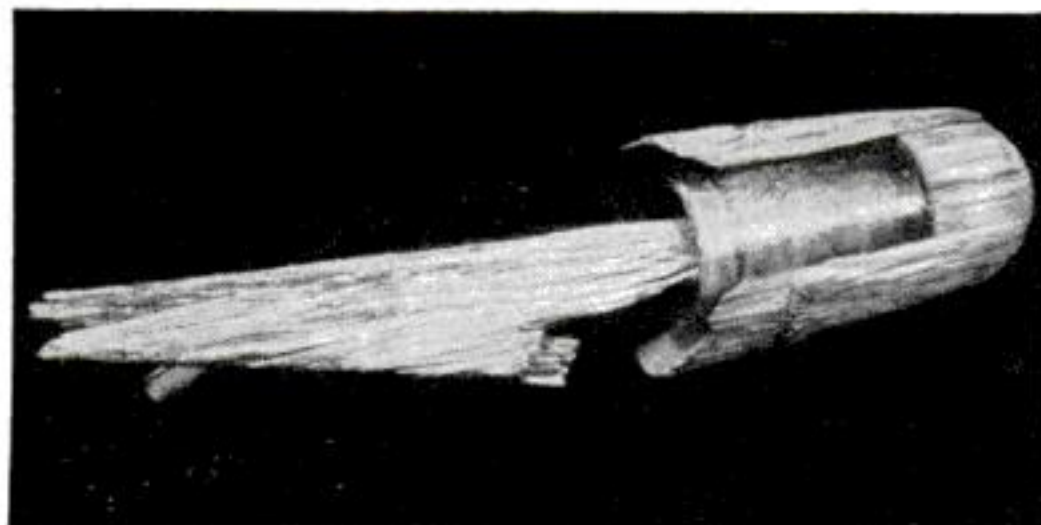
"But it didn't drag on the jack."

Gus laughed. "You can stop a free-turning wheel just by touching the brake. But after he hit them hard enough to stop the car a couple of times, the springs stretched so much they couldn't pull the shoes clear of the drum."

"I get it," said Corcoran. "Well, we're sure grateful, and that's official. Only one thing I'm sorry about."

"What's that, Jerry?"

"You've lost a customer, Gus—for something like five years." ■ ■



What is this?

Can you tell what's in the picture at left? Check your answer below

ANSWER: No, it's not a rocket speeding in space or a piece of old, flotsam driftwood. It's an old, weathered, glass-and-wood insulator bracket used to hold telegraph wires along early Union Pacific railroad tracks.

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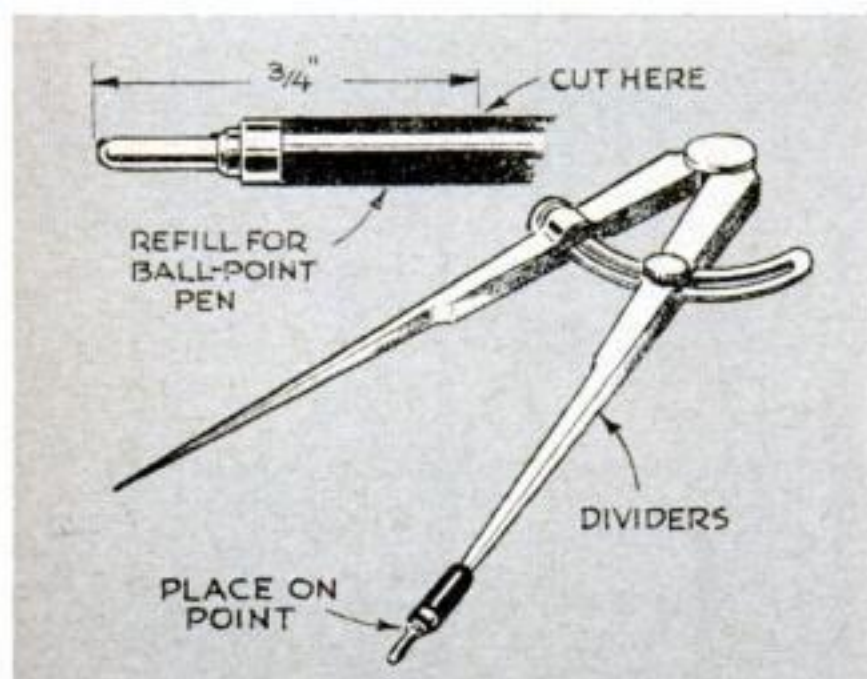
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PRODUCTS OF  MOTOR COMPANY

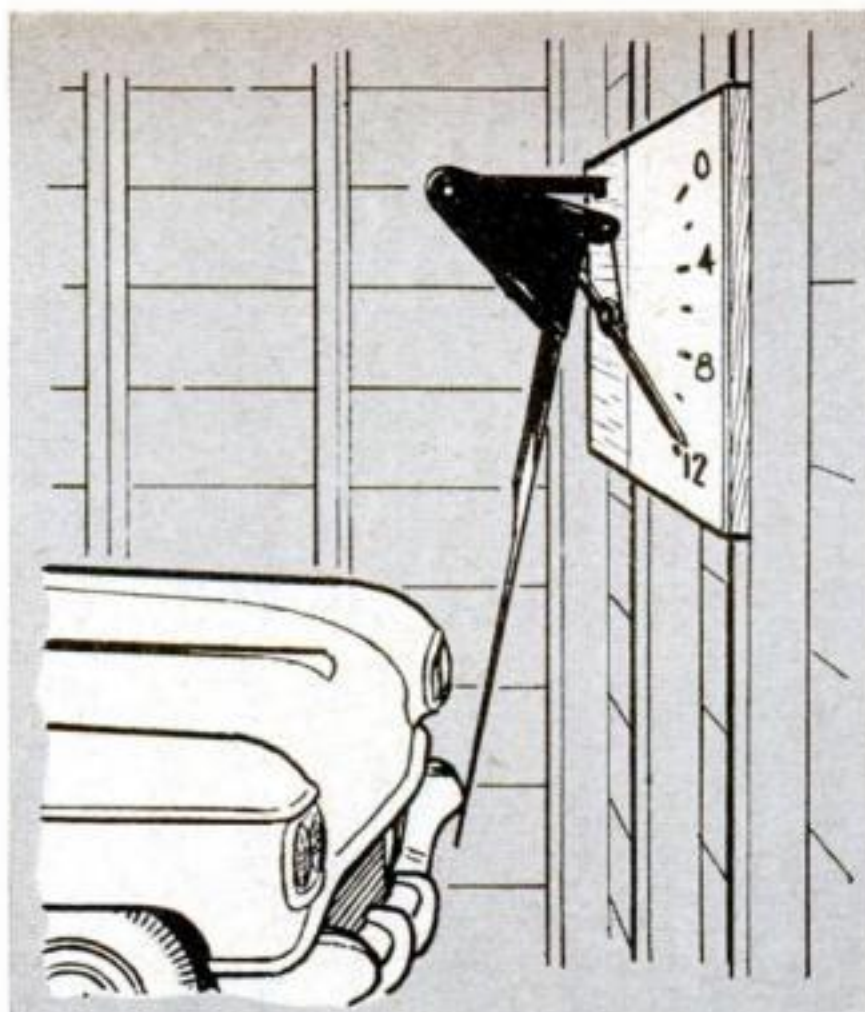
Short Cuts and Tips

FROM PS READERS



A Simple Emergency Compass

CAN'T find a compass when you need it most? I improvised one in a jiffy by snipping the ball-point tip off a cheap pen cartridge and forcing it onto one of the points of a pair of dividers. Circles show up so well that I continued to use my emergency compass after I found my other one.—Gary Young, Auburn, N.Y.



Distance Gauge for Garage

SPACE is critical when fitting today's longer cars in standard garages. To avoid butting the wall, I built this gauge to tell me about that final foot. The car bumper presses a long lever that lifts a pointer up a graduated dial to show me how many inches my car is from the back wall.—P. Muller, Armida, So. Africa.

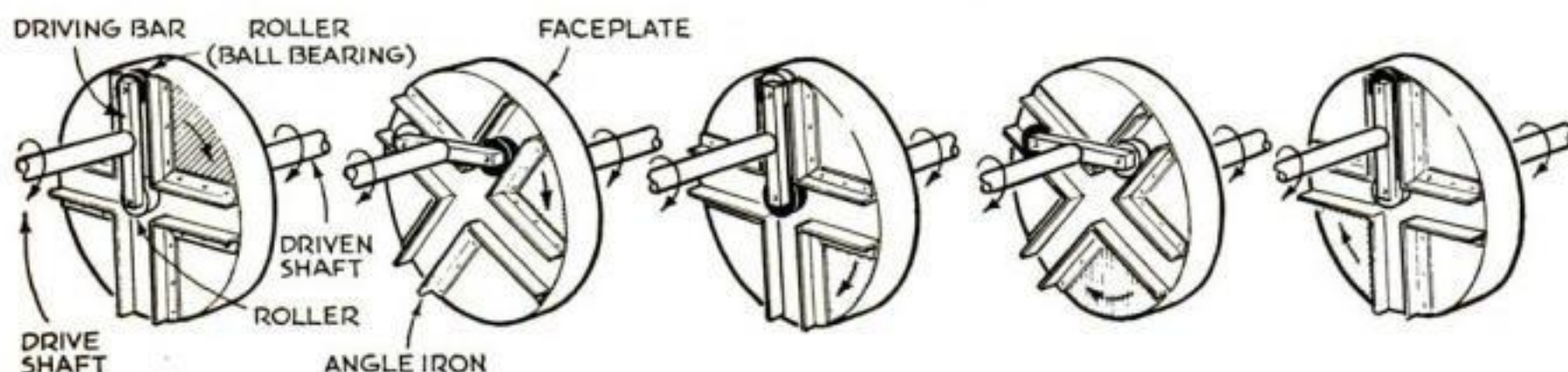
Answer to the Case of the Gearless Reduction Drive (See page 184)

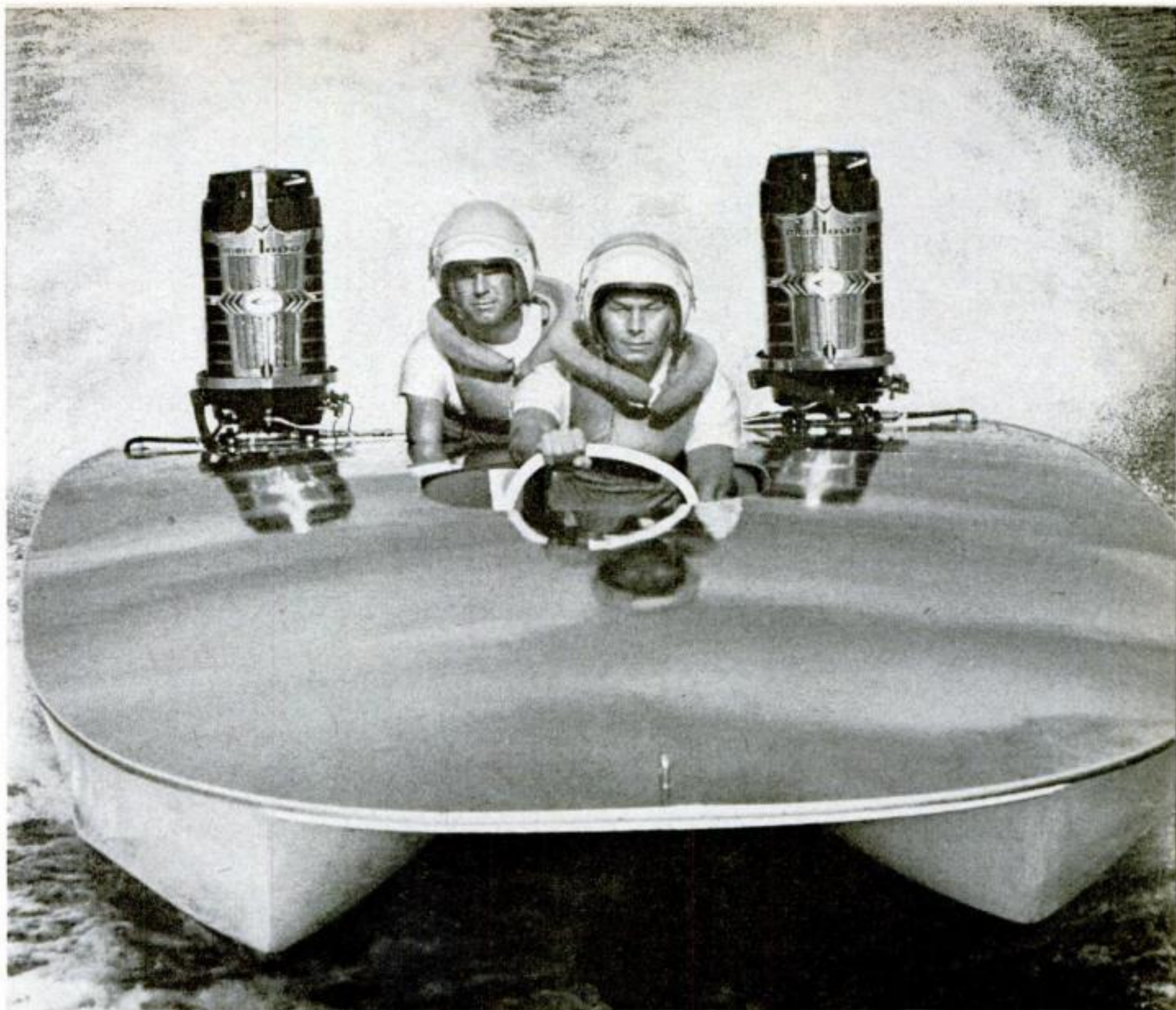
SMOOTH-FILED pieces of angle iron were riveted to a faceplate to form four slots at right angles and wide enough for the outer bearing races to roll in. On a bar fastened to the drive shaft, the bearings were mounted twice the shaft spacing apart. Instead of overlapping, the shafts were cut short to let slots and bearings work face to face.

As the rollers swing around clockwise (first sketch), the lower one moves into

the left-hand slot and the top one swings the upper slot to the right (next sketch).

When roller 1 (black) is at the center and roller 2 (white) at the top (third sketch), the drive shaft has made half a revolution, but the driven shaft only a quarter one. In the last sketch, the faceplate has revolved only halfway. Thus two rollers and four slots give a 2:1 reduction but—unlike gears—don't reverse rotation.





Fast...will last!

We'd like to have a nickel for every time our competitors tell a motor prospect that "a Merc's great for racing . . . but it won't hold up."

When you stop to think about it, this is the nuttiest thing anyone could say. If a Merc's great for racing, it's *got to hold up*.

Mercurys *do* win more outboard races than any other motor. But, what kind of races do they win? Races that prove *endurance*.

Races like the Mississippi Marathon—1068 miles at full throttle. Just as stock cars are proved on the race tracks, so are Mercs *proved* in the grueling marathons. But, this is just a normal day's work for a Mercury at our test center at Lake X, Florida.

In fact, back in 1957 two standard produc-

tion 60 hp Mercs set the world's outboard endurance record . . . 50,000 continuous miles in 68 days (and nights). And, the new Mercs are even better today. The slide-rule boys will tell you this is equal to 30 years of average boating!

We're proud of our racing record. It proves the guts of our engine . . . and our engineering. It proves a Merc can take more punishment *with less maintenance*.

It proves a Merc gives you more RUN for your money!

MERCURY

100, 85, 70, 50, 45, 25, 9.8, and 6 horsepower outboards

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Short Cuts and Tips

FROM PS READERS

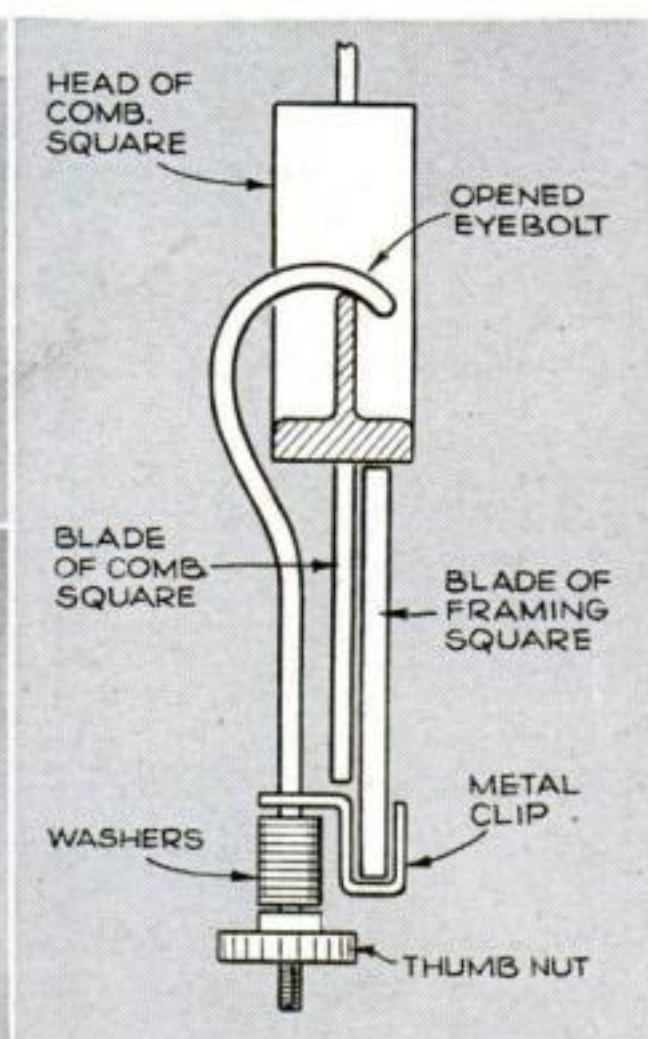
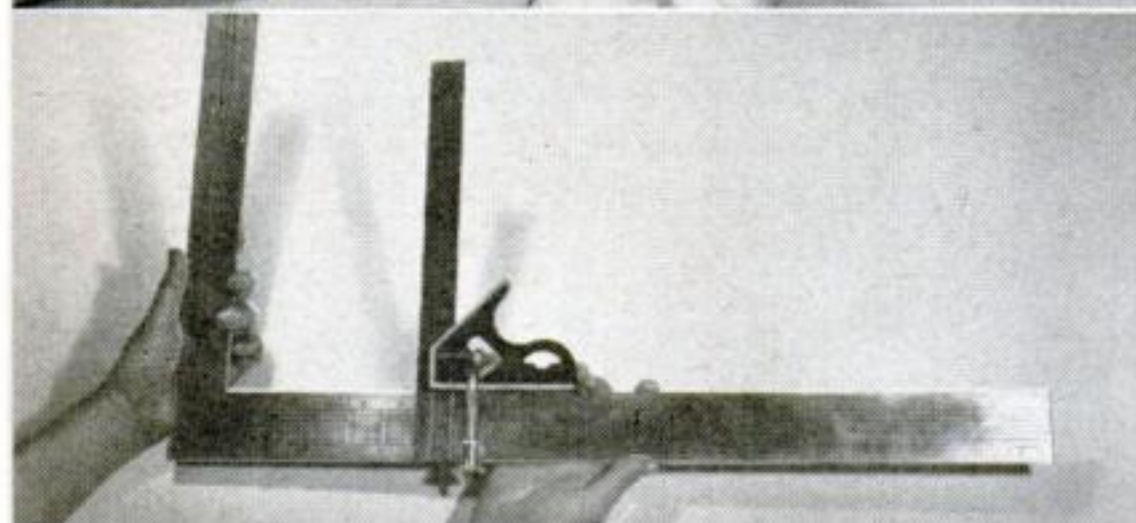
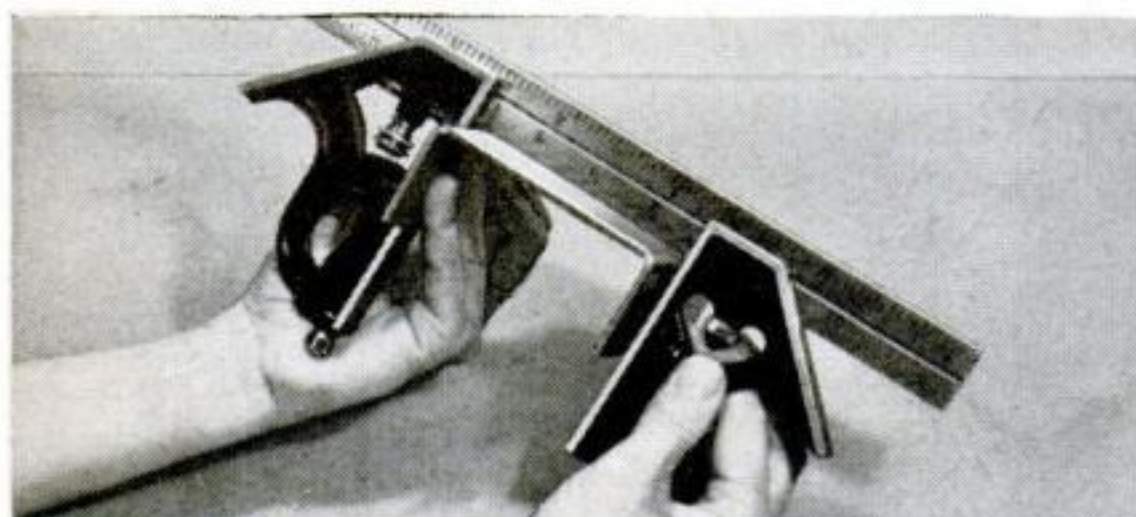
Screens for the Garage Door, Too

SINCE our house has no porch or patio, we use our attached garage for summer activities. Insects swarmed through the opening when the door was raised until I replaced the solid panel with a framed screen built to the same dimensions and attached to the swing-up hardware. During the winter, it stores neatly against the wall.—*Leland K. Roberts, Lewisville, Ind.*



▶▶▶WHEN cutting sheet metal, lubricate the blades of your tin snips by first rubbing the stub of a candle along the layout line. The wax path makes cutting much easier, particularly around sharp curves.—*Jim Purves, Peru, Ind.*

▶▶▶WINDING a bedside clock at odd hours is hard on it. Fold a piece of adhesive tape over the alarm key to distinguish it from the one that winds the works, and you won't twist the wrong one—even in the dark.—*Mrs. M. Strobel, Union City, N. J.*



Try a Double Try Square

SLIP a second head on the blade of a combination square, and you can check three sides (two corners) of a piece at

once. To test a larger piece for squareness in a similar way, attach a 12" combination square to a carpenter's framing square with a clip sliding on an opened eyebolt.—*Robert Micals, Freehold, N. J.*

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Hide scratches with crayon-like Weldwood Putty Sticks®. You can fill nail holes and other wood blemishes after the wood has been finished and waxed! Assorted colors to match almost any finish.

Smart idea! Set aside a shelf in your workshop for the Weldwood® glues and finishes you'll need in the coming months. You'll save time and trouble—and do a better job, too—because you'll always have the *right* materials on hand when you need them. Suggestions: Weldwood Plastic Resin and Presto-Set® Glues, new Deep Finish Firzite, Satinlac® self-sealing natural finish, Weldwood Putty Sticks, and Flexible Wood-Trim® for edging plywood. At lumber yards, paint and hardware stores.

FREE-8-PAGE BOOKLET! "Professional Gluing And Wood Finishing Guide." For free copy, write: United States Plywood, Dept. PS 2-62, 55 W. 44th St., New York 36, N. Y.



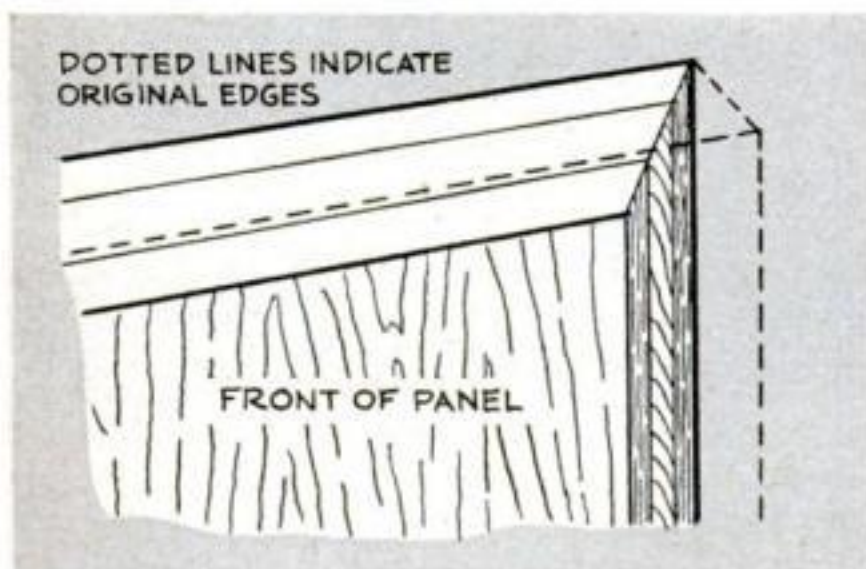
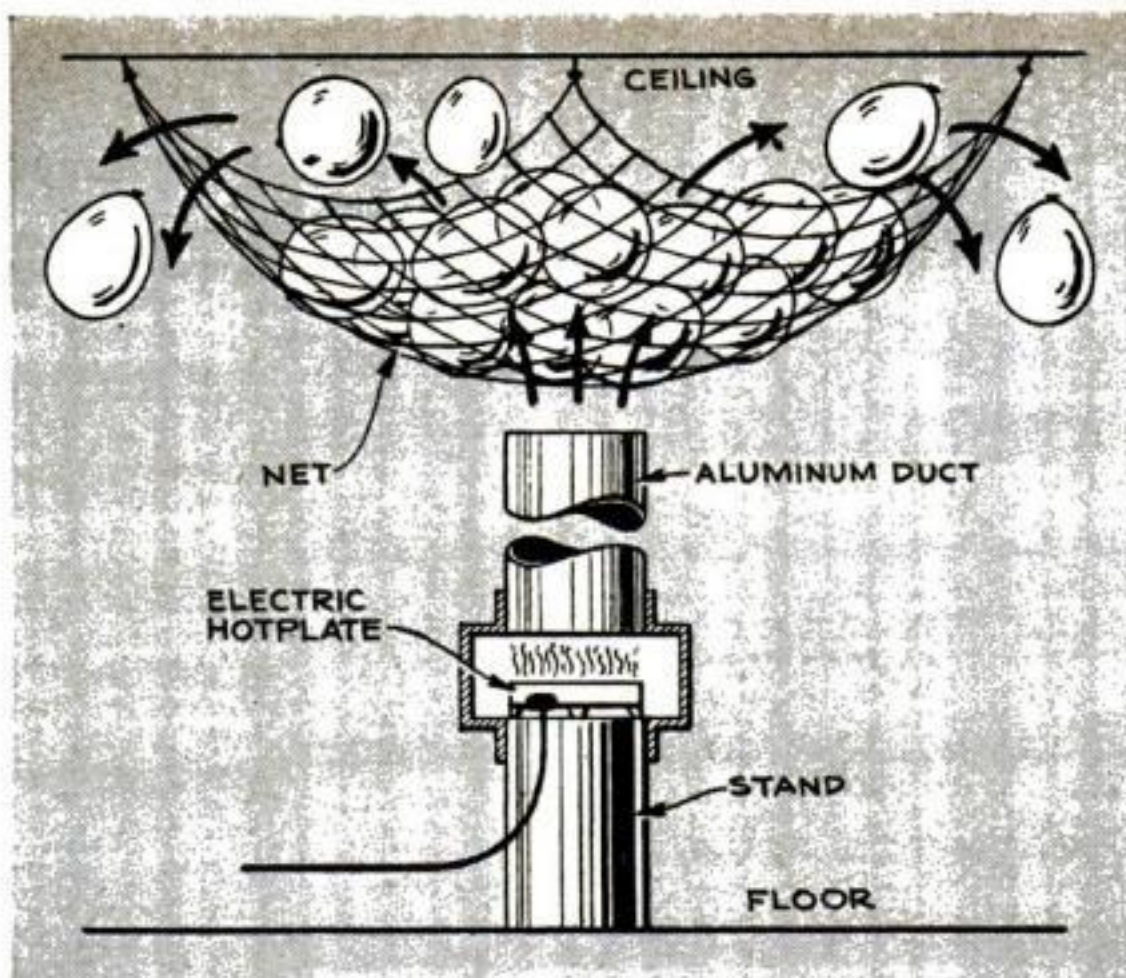
Products of United States Plywood

Short Cuts and Tips

FROM PS READERS

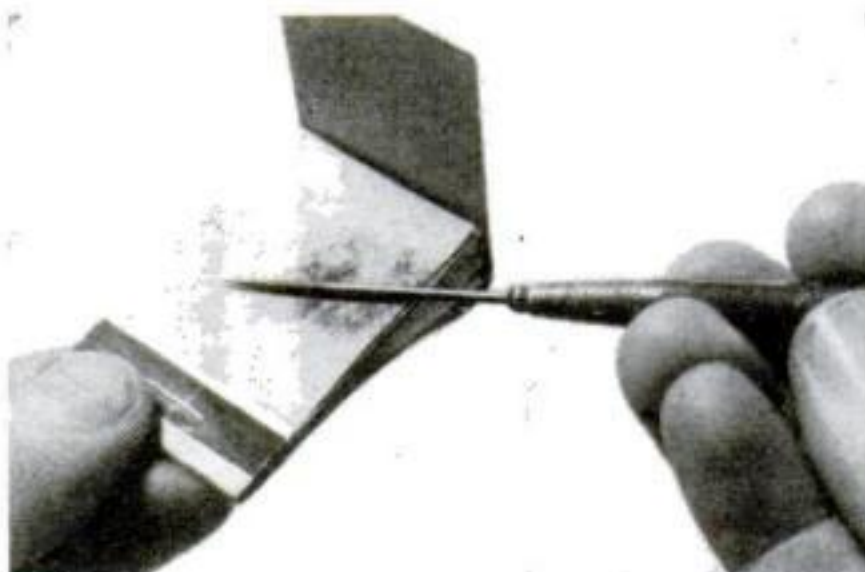
Hot-Air Blast Releases Balloons

THE sketch shows the method one night-club owner devised to release a load of inflated balloons caged in a net near the ceiling. As soon as the electric hotplate began sending hot air up the duct, the balloons were carried out over the net and floated down into the restaurant.—*W. C. Wilhite, Carlinville, Ill.*



Dressing Up Plywood Edges

USING plywood for cupboard doors or table tops? Give the exposed edges a more finished look by beveling them toward the back. This widens the plies so they sand smooth and take a better finish. Bevels are most effective on panels that are $\frac{1}{4}$ " and $\frac{3}{8}$ " thick.—*Carlton Bucher, White Plains, N.Y.*



Matchbook Pencil Sharpener

DRAFTSMEN and photo retouchers must keep a sharp point on their pencils. Fine sandpaper does the trick, but an open sheet of it is messy on the drawing board. Instead, cut small squares and staple them into an empty matchbook cover; when a sheet fills up, tear it out and discard it.—*Wayne Floyd, Fayetteville, Tenn.*

Drain-Plug Furniture Feet

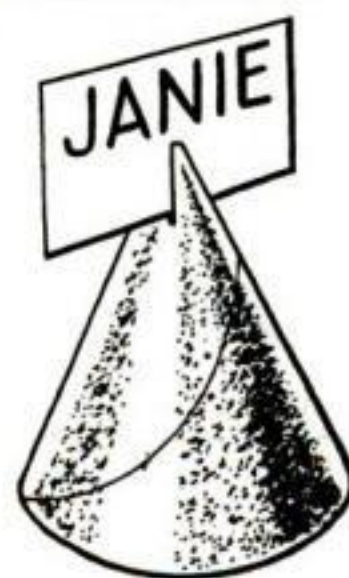


CAN'T find crutch tips to fit odd-size tubular legs? Use cup-type rubber sink-drain stoppers. They come in a lot of sizes.

Just slice off the chain ring and knob with a sharp knife.—*Frank A. Javor, North Bergen, N.J.*

Holder for Party Place Cards

THOUGH this month is the year's shortest, it's peppered with holidays. If you are giving a party, print place cards on stiff paper. Insert them in slits in the point of paper drinking cups.—*William Eagan, Maceo, Ky.*





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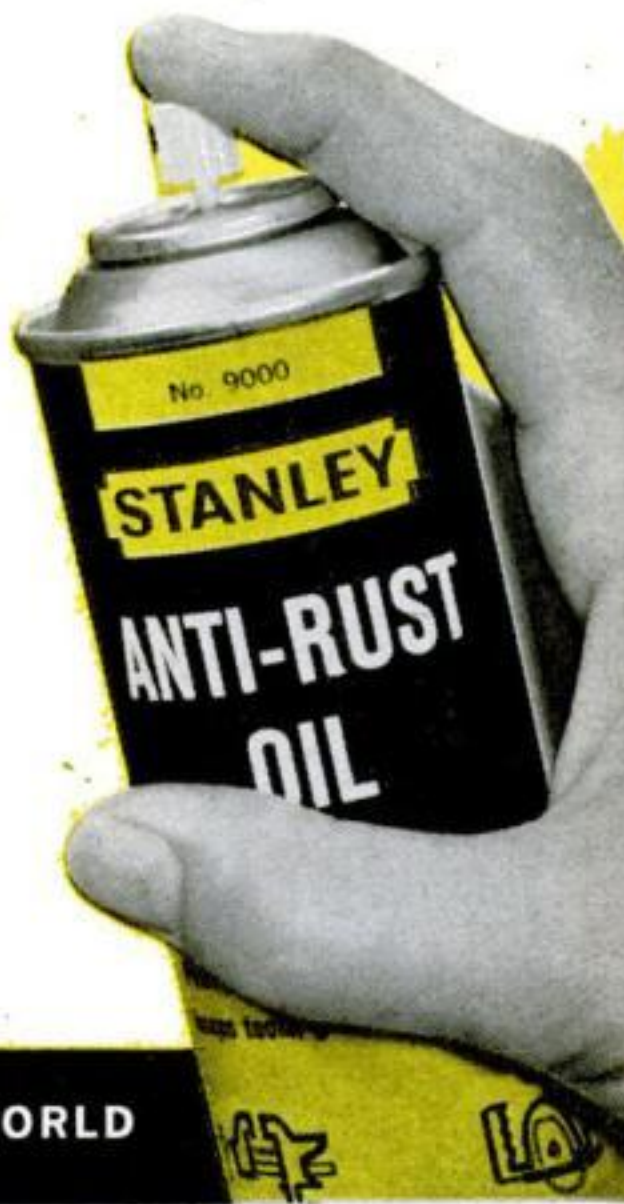


RUSTY TOOLS . . . GUNS?
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NEW STANLEY CHEMICAL TOOLS

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SEND FOR FREE SPRAY HANDLE—50¢ Value. Converts any spray can to spray gun in seconds . . . keeps hands clean. Write, enclosing "Special Offer" sticker or Number cut from front of can label, to Stanley Tools, Division of The Stanley Works, 632 Elm Street, New Britain, Connecticut.



STANLEY

THE TOOL BOX OF THE WORLD

10 Toughest Problems of Putting a Man on the Moon

[Continued from page 121]

tested. A choice between a liquid or solid Nova, after flight tests of each, is expected within three years.

For upper stages, high-energy liquid hydrogen has been a favored fuel—but now atomic energy looms as a dark horse. Recent Nevada tests encourage hope for a flyable A-engine for rockets as soon as 1965, and moon-trip planners are eyeing its advantages.

4. Choosing the target. Where the manned craft lands on the moon may spell the difference between triumph and disaster. Within lunar craters, rock dust hundreds of feet deep could swallow up the space craft and its crew.

The lunar "seas" or plains promise the safest places to touch down, a recent study suggests. They are believed to be covered by only a few inches of the all-pervading rock dust—not enough to hinder a landing or exploration.

Surer information about the moon's surface will be needed, however, before even the landing gear of the Apollo craft can be designed. Getting it will be a task for unmanned moon vehicles, in preliminary flights. Besides surveying the lunar terrain for a good landing place, they will plant beacons at the site to serve as aids for manned landing.

5. The lunar landing. As the moon's features suddenly loom large to the men in the capsule, they will face a hair-raising maneuver. Since the airless moon will support neither wings nor a chute, backward-firing rockets must check the craft's 5,000-m.p.h. speed—so precisely that it settles gently to a safe landing on the lunar surface.

Though often pictured in space fiction, this novel way of landing has never been tested. No vacuum tank on earth is big enough for the experiment. *The only way it can be tried is on the moon itself.* So crewless lunar craft must rehearse and perfect the soft-landing technique prior to a manned attempt.

A manned moonship has often been pictured as landing vertically. But if it is drifting sideward, as it descends, it might topple and crash on touching the ground. So NASA is weighing this plan:

Tail first, the craft may skim in to a horizontal landing. After retrorockets have braked its forward speed, reaction

jets along its bottom serve to cushion its descent to a landing on skids.

6. The lunar takeoff. When the explorers are ready to return, they will get their first break: Because of the moon's weak gravity, takeoff is easy.

Blasting off, the remanned capsule will retrace the path of its descent. Thus, if the landing was a horizontal one, the takeoff will be in similar style—the capsule leaving from the end of the landing craft, still lying on its side.

A single rocket stage of modest power will suffice. The problem will be to assure its reliability; its failure would maroon the crew on the moon.

7. Re-entry. Like a hurtling meteor, the capsule will re-enter the earth's atmosphere at 25,000 m.p.h. Can it shield its occupants from the searing heat of the air's friction? Because of its greater speed, the task will be far more difficult than that of capsules for earth-orbiting and suborbital flights.

The crew's lives will depend on how accurately the capsule can be guided into a favorable re-entry corridor above the earth's rim. The margin of error can be only 20 miles above or below the ideal trajectory—a requirement that will tax the most expert space navigator.

8. The homecoming. Though wingless, the Apollo capsule will be so shaped as to have some aerodynamic lift. Its crew will be expected to guide it, by controlling its attitude with jets, to a pre-selected landing place on earth. In case it should miss the spot, it must be able to come down safely either on land or water—no small order for designers.

For the actual landing, says NASA, "parachutes or similar devices" will serve. One alternative could be a Rogallo wing—an unfurlable, kitelike airfoil of plastic fabric, promising in trials.

9. Emergency! To all the perils noted so far must be added even eerier ones to be countered:

Tiny meteors, puncturing a moonship's hull, would endanger men and equipment. For protection, NASA experts envision a "meteor bumper"—a false outer hull.

Against dangerous radiation in space, weight limits allow only the lightest of shielding. That, plus high speed, may

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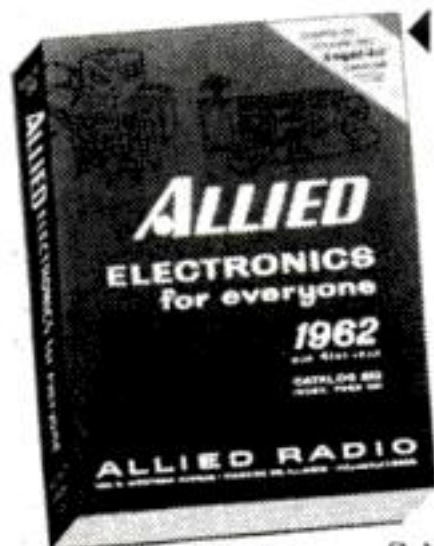
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**WORLD'S
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Putting a Man on the Moon

get the crew safely past the Van Allen belts of radioactivity above the earth—but cannot protect them from the deadlier radiation of occasional solar flares. If one of these catches the crew moon-bound, they will have no choice but to turn tail and streak for home. By developing a flare-predicting system, an effort already begun, it may be possible to choose a safe period for the flight.

What of the nightmare prospect that a breakdown could strand the crew somewhere in the vastness of space? By that time, NASA hopes, the rendezvous technique may be so advanced that a rescue ship could reach and save the men.

10. Pioneering the way. An elaborate program of preliminary ventures—each in itself a major undertaking—must precede a manned lunar expedition.

Crewless vehicles—Rangers, Explorers, Prospectors—will lead the way to the moon. Beginning this year, Ranger will drop instruments to a “hard” lunar landing. Explorer and cargo-size Prospector will pioneer “soft” landings.

Meanwhile, the Apollo capsule will figure in two manned space missions:

Orbited around the earth for two to eight weeks, the capsule will serve as a three-man space laboratory—and training craft for spacemen. The launching rocket: the new Saturn, called the C-1, which has eight kerosene-oxygen booster engines, each of 188,000-pound thrust.

Next Apollo-capsule mission will be a manned flight around the moon, without landing. Launching it may take a projected rocket, the Saturn C-3—whose two Nova-type booster engines will give it double the thrust of Saturn C-1.

Then will come the climax, the manned lunar-landing mission.

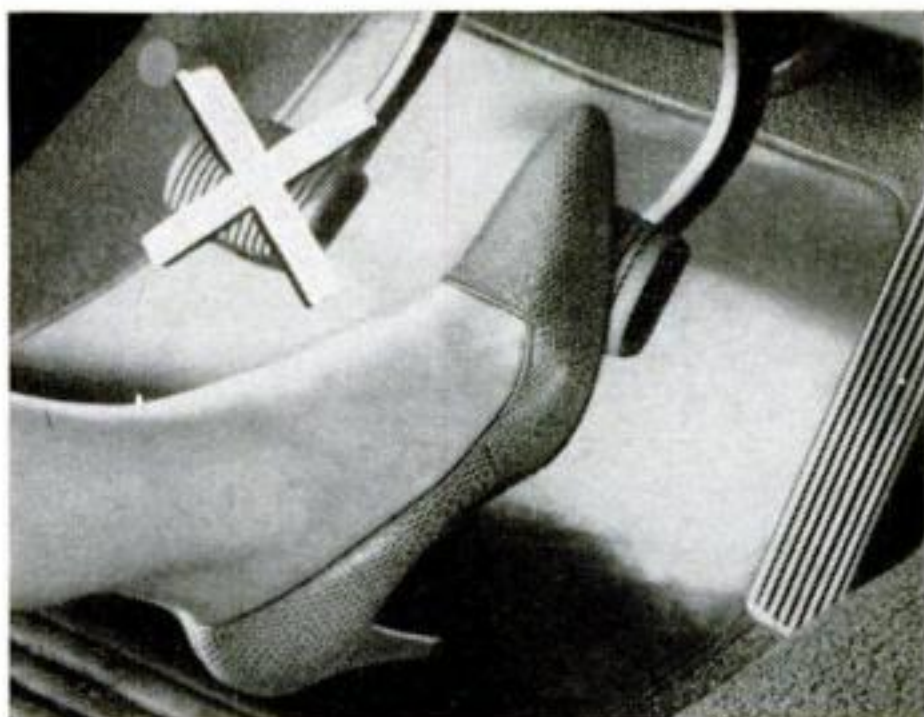
So the wonder is not that putting a man on the moon will take so long—but that there is hope of doing it so soon.

As recently as 1958, scientists saw the earliest likely date as 2000 A.D. Then, last May, President Kennedy called for a manned lunar flight in this decade as a national goal—and Congress voted the first installment of the huge cost.

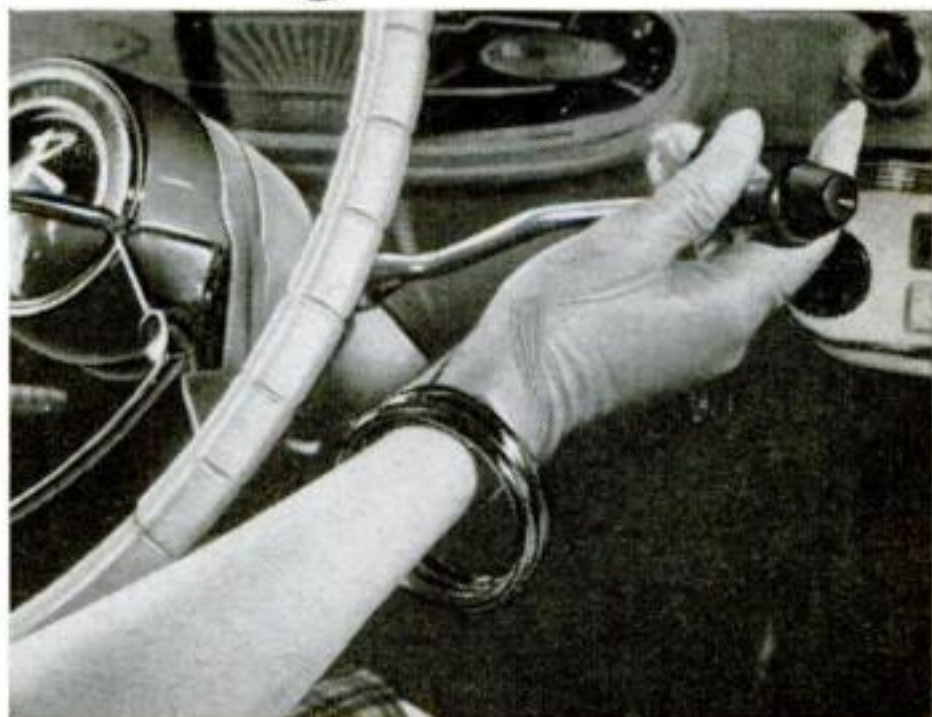
And so, today, NASA administrator James E. Webb offers this new prediction of the actual date: 1967 or 1968. ■ ■

Next month: How robot vehicles will explore the surface of the moon.

New Rambler "E-Stick" rated big '62 auto news



E for Ease. No clutch pedal. Most of the convenience of a full automatic at about one-third the cost.



E for Economy. Automatic clutch with the gas mileage, performance and control of a stick shift.

In New Rambler American \$59.50 Buys No-Clutch-Pedal Driving with stick-shift economy and control

Nothing like it. Experts call it the biggest automotive news of 1962.

Try it. You have precise control in shifting.

You have full engine braking going downhill. You can rock the car swiftly from low to reverse and back in mud, sand, ice or snow.

You shift without a clutch pedal. An automatic clutch—activated by engine oil pressure—operates the clutch when you move the lever. Quicker, more accurate than your left foot, according to experts who have tried it.

Cost—only \$59.50*. In fact, the Rambler American Deluxe 2-Door Sedan with the amazing E-Stick costs less than any other U.S. car with standard transmission, but

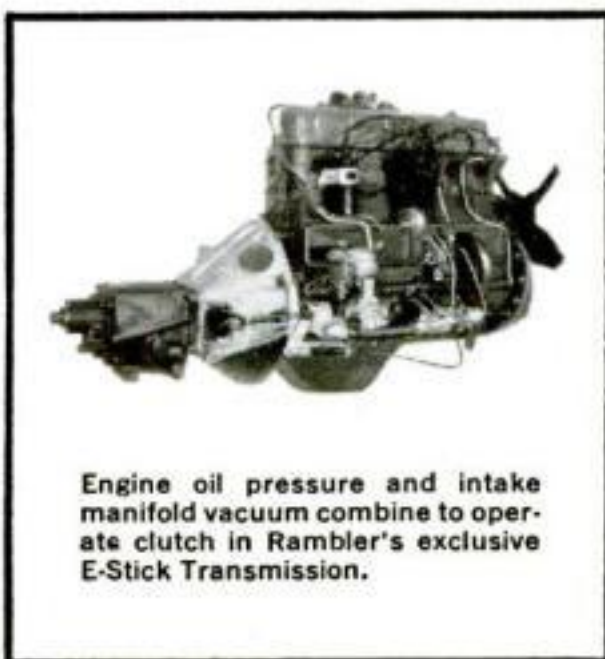
gives you no-clutch-pedal driving ease.

This is but one of many Rambler advances for '62. Rambler progress sharing brings

lower prices on all models—with new Double-Safety Brake System standard—tandem cylinders for front and rear—(as on Cadillacs). Self-adjusting brakes standard, too. Twice as long between engine oil changes. Low-cost engine coolant good for 2 years. 2-year battery.

Compare Rambler with the other best-sellers. See how Rambler's 102 improvements for 1962, plus new lower

prices on all models, give you an obviously better value in product and price.



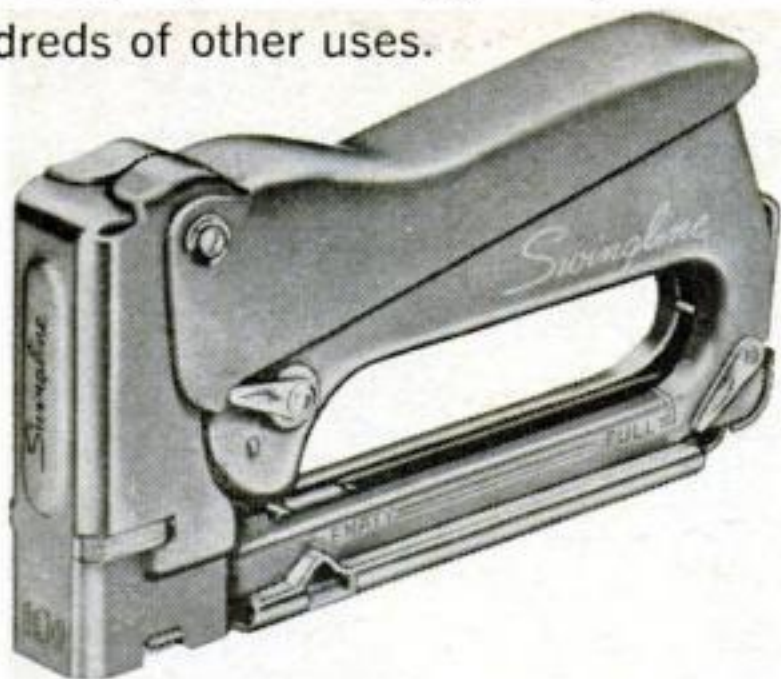
Engine oil pressure and intake manifold vacuum combine to operate clutch in Rambler's exclusive E-Stick Transmission.

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Dreamboat for Everybody

[Continued from page 70]

We scrambled over the foredeck to the beach without even dampening our soles. Leaving the beach, I simply put it in reverse and we backed out into the channel—no tugging, lifting, or wading. I've had more trouble backing out of a parking place.

Out in the Gulf there was a swell rolling in, intersected by a rather sharp cross chop—perfect weather for getting drenched in a fast open boat. With the blunt bow and shallow forefoot on this craft, I figured there'd be plenty of spray at speed, either directly taken or squished out forward and then run into. I also anticipated that there might be a problem of getting the bow to rise fast enough as it nosed into a swell—which would mean that she'd take water over the bow.

So I headed out to sea, shoved the throttle forward all the way, and prepared to get wet. But I didn't. The windshield didn't even get sprinkled. All the spray that I could work up under those conditions went out low, flat, and well to the side.

Even in rough water the boat handled like a nicely engineered sports car on a banked track. She took hard turns on an almost even keel, with little sideslip and no tendency to trip. The steering remained precise, with little correction needed to maintain course.

Her top speed with two aboard was an indicated 34 m.p.h. As with any planing hull, the ride was harsh at high speed in rough water. But it wasn't as thud-thud-thuddy as you might have expected—partly, I discovered, because of the seats. A lot of engineering effort had evidently gone into them; they absorbed shocks well but didn't toss you around.

The story behind the hull design. You can sometimes solve a knotty problem by backing into it. This is what happened aboard an executive plane flying back to Waukegan one night a couple of years ago.

Clay Conover, Outboard Marine's director of marine engineering, and Harry Ewald, then chief engineer of the Boat Division, were discussing the day's disappointment with a naval architect and a boating consultant. They had just witnessed tests of their latest, most

Dreamboat for Everybody

promising hull design at OMC's testing station in Naples.

The three-point runabout with double-entry bow had performed and handled beautifully, except for one unforgivable fault: It was a *very* wet boat when the going got rough.

They had tried all the standard fixes for this nuisance, common with this general design. Nothing had worked out.

Sitting around a table in the plane that night, someone suggested going back to the traditional single-entry bow.

"Okay, but then how do you get the stability we need?"

"Well, maybe we could add sponsons on either side of the bow—outriggers."

"Then you'd have too much drag."

"How about making the center bow shallow enough to clear the water when she's planing? It wouldn't add drag at speed, yet it would give lift when a wave rises under it. It should also throw water to the sides instead of squishing it out forward."

The notion sounded promising. The next day a new hull was under way—the turning point in a long development program during which more than 40 different hulls were designed, built, tested—and rejected.

Analyzing the boom. The story of why these men were fretting over hull design is revealing. Back in 1959 Outboard Marine took a hard look at sales figures. The boating business was booming, all right, but growth was leveling off. Over 80 percent of sales were to customers who already owned boats. The proportion of new customers was declining each year.

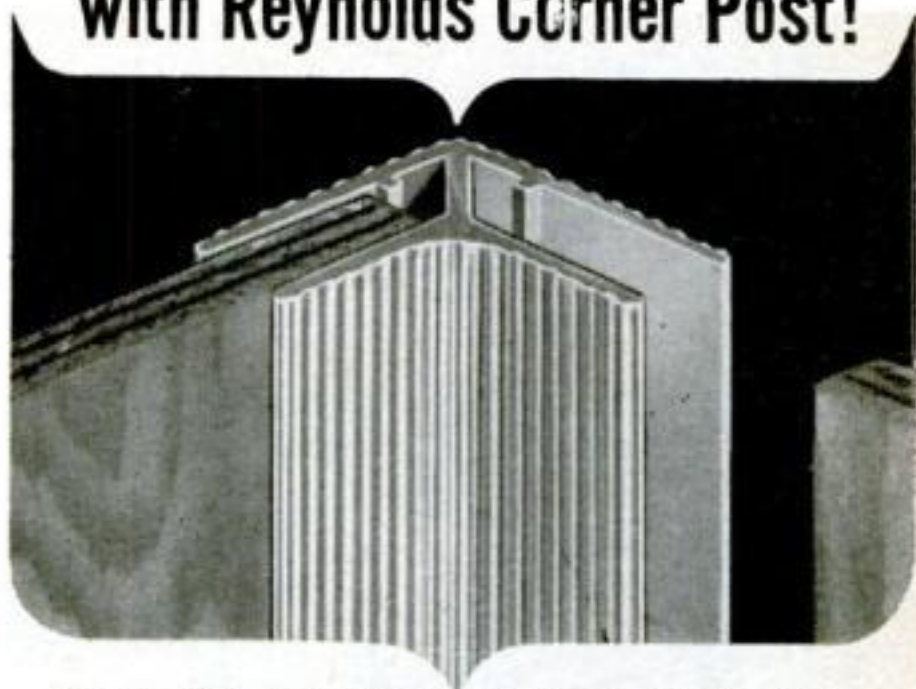
They started to look for answers. Several surveys later they had arrived at two main conclusions: 1) The boat business was running out of adventurous-minded customers who didn't mind getting wet, putting up with assorted discomforts, learning special skills for handling conventional small boats, and spending considerable time or money for maintenance. Furthermore, they found 2) that many a potential customer was lost because his wife didn't feel safe and comfortable while waterborne.

The boating industry, in other words, could take a lesson from Detroit. To open up a big, new market, a new ap-

CONTINUED



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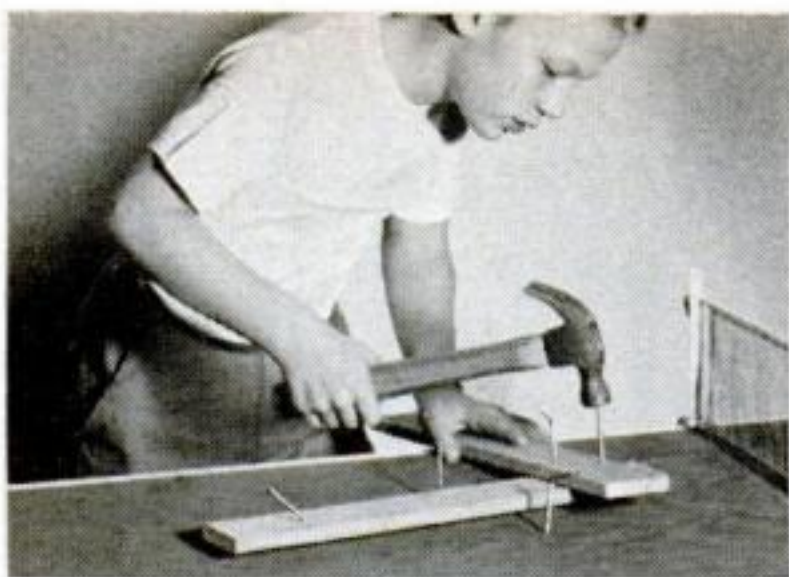
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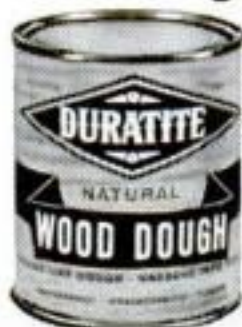




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Dreamboat for Everybody

proach to boating design and manufacture was needed. To keep the price attractive, the complete package—hull, power plant, and fittings—would have to be mass-produced on assembly lines just like cars.

The decision. OMC decided to go into the business of manufacturing complete boats. They already had what they considered an ideal power plant: an 80-hp., V-4 stern-drive unit, then almost ready for the market. But to hit their target, they set these goals:

- A complete package with nothing left for the customer to buy except gas and oil.

- The comfort, convenience, ease of operation, and feeling of security of a family automobile.

- Freedom from ordinary boating maintenance.

- Prices comparable to those of a middle-priced automobile.

A study of the costs of boatmaking turned up one surprising fact: The biggest slice of the cost of a finished boat (about 80 percent) was for raw materials—not, as commonly thought, for labor and overhead. Even with mass-production economies, it became apparent that they couldn't give the customer all the goodies they wanted to—at a competitive price—unless they found a way to squeeze material costs.

Aluminum and glass-reinforced plastic were top contenders for material choice. But the suppliers of neither could get the price down to where OMC thought it had to be. OMC decided to produce their own glass cloth. (Aluminum was too tough.) That cut cost of materials in half.

The hull. The production hull is made up of three laminations—glass cloth, glass mat, and an outer "gel" coat of resin plastic—molded in one piece in a heated female mold. Two-thirds of the final weight is resin; the rest, glass.

The void between the bottom and the glassed 1/4-inch-plywood cockpit deck is filled with 22 cubic feet of self-foaming, rigid cellular polyurethane flotation material. (One test hull has been floating for a year with a dozen one-inch holes drilled through her bottom; she hasn't sogged up yet.)

The upper deck is molded in one

Dreamboat for Everybody

piece of the same construction as the hull. The color and a nonskid surface are molded into it. The foredeck is reinforced forward of the cowling with $\frac{3}{8}$ -inch plywood.

Hull depth is 2'4 $\frac{1}{4}$ ", length 17'2 $\frac{1}{2}$ ", beam 7'4", free board (loaded) 1'6", draft (loaded) 1'0", loaded weight (no passengers) 1,664 pounds.

The engine and drive. The new OMC 480 stern-drive unit combines most of the best features, company engineers argue, of an inboard and an outboard. The light V-4 engine is almost entirely die-cast aluminum. Cylinder liners, bushings, and other inserts are cast-in. It develops over 80 hp. with a displacement of 90 cu. in.—a specific output of .9 hp. per cu. in.

The lubrication system is unusual for two-cycle engines. Instead of mixing oil with the gas, the oil supply is in a separate tank. A metering pump delivers a squirt of oil to each cylinder once every 20 revolutions of the crankshaft. Oil is injected directly into the cylinder just below the valve ports.

There is double protection against operating the engine without oil. Two float-operated switches in the oil-supply tank are the first line of defense. When enough oil is left in the tank for an hour's operation, one switch lights a warning light on the dash. If a dumb and happy driver ignores this and the oil supply is exhausted, the other switch wakes him up: It shorts out the ignition. Backstopping this protection is a pressure-operated switch on the oil pump that also shorts the ignition if the oil pressure drops.

This separate-oil system is envisioned as having three big virtues: 1) convenience on refueling; 2) much longer spark-plug life than two-cycle engines have so far shown; and 3) drastically reduced periodic engine maintenance.

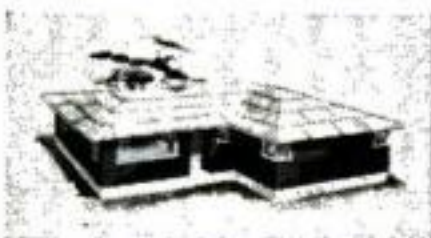
The electrical system. Another feature is an alternator built into the engine flywheel to supply the boat's electrical system. The wound stator is inside the flywheel housing and requires no brushes. The permanent-magnet rotor is brazed to the flywheel. The alternator supplies 5 amps at idling speed and 20 amps at 2,000 r.p.m. A transistor regulator controls voltage over the operating-speed

CONTINUED



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Pushbutton help

Direct pushbutton contact with police or fire department is made possible by this emergency telephone. Several units are planned for Munich, West Germany. They will be mounted on traffic-signal pillars, where they can be located easily.

Dreamboat for Everybody

range. Four silicon diodes change the single-phase alternator output to DC.

The drive unit comes complete with a propeller properly matched to engine and boat. You also get a spare prop. The propeller is steerable—the whole lower unit is turned about the drive-shaft axis by a nonreversible steering gear. A trim tab mounted in the propeller slipstream counteracts torque so you don't have to hold the wheel against a constant pull in one direction. An electric motor drives the rack-and-pinion power tilt so the drive unit can be raised or lowered by the flick of a switch on the dash. A disk clutch in the tilting drive train absorbs shock and allows the unit to tilt up if it strikes an obstruction. Forward, reverse, and neutral gear selection is by electric clutches in the underwater gearcase. These are operated by switches on the single-lever throttle-shift control.

The water pump is also in the lower unit where it's submerged and priming is insured. Cooling water for the engine runs up through passages in the tilting pivot journals.

The fancy doodads. To keep costs down, mass-produced automobile accessories have been used where possible. For example: A motor used for power-operated seats in cars is used to raise and lower the drive unit; a convertible-top motor runs the bilge pump and blower; the power-raised windshield uses an auto powered-window motor; the horn, battery, wiper, and gauges all come from auto-parts suppliers.

A white vinyl convertible top shields the entire cockpit and folds out of sight under the rear deck. Zippered side curtains and snap-on rear curtain make a weathertight sleep-in camper.

The OMC-17 De Luxe will sell for about \$3,500. A utility two-seat version without the top will be about \$2,850. These are the first of a proposed full line of boats.

As I tied up the boat after a hard day behind wheel and notebook, I said to Ewald, "Looks as though you've given the holiday-happy American family everything to make them feel at home except Sunday traffic. What next?"

"We'll take care of that, too," he said, grinning. "Just as fast as our production lines can turn out boats." ■ ■

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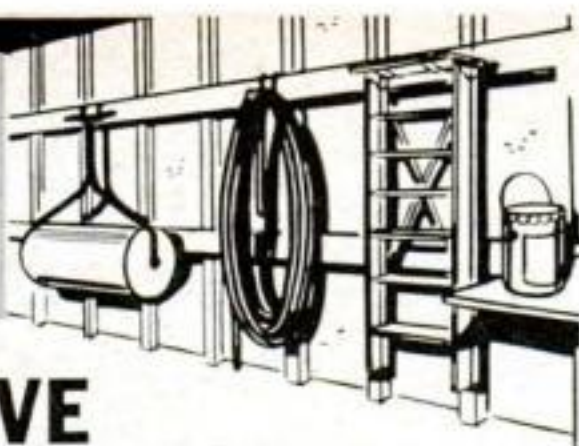
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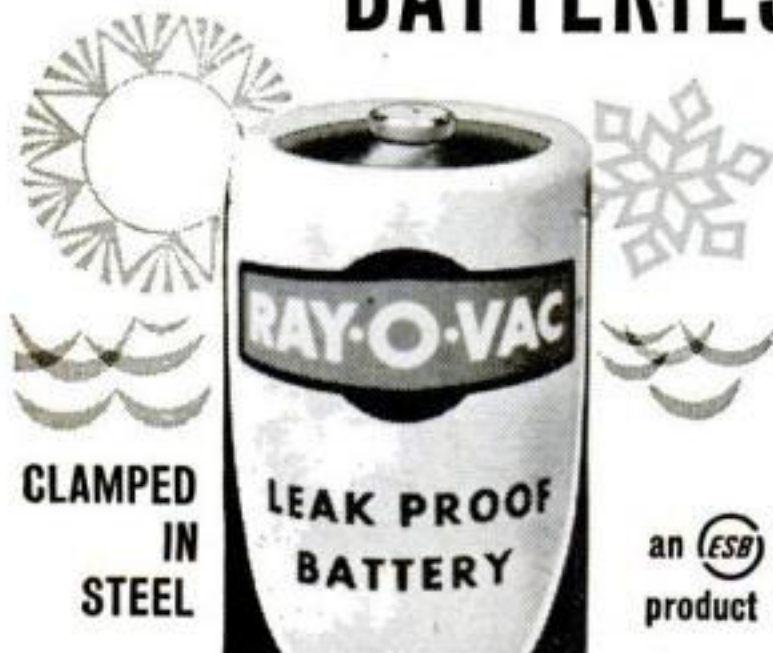
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Will Tomorrow's Cars Burn Kerosene?

[Continued from page 77]

The answer to cost may lie in a new heat-resistant alloy Chrysler has developed. "In large-scale production," Huebner told me, "this alloy should enable us to make a drive turbine for \$10 or so."

Chrysler's competitors see no gas-turbine sedans on the road in the foreseeable future, but Ford and General Motors are also improving the motor in larger sizes. Ivan Swatman, design supervisor of Ford's gas-turbine project, showed me a new 300-horsepower supercharged gas turbine, much more complex than Huebner's, which had been fitted for size under the hood of a Ford sedan, then moved to a truck, where the company thinks it belongs. Only one-fourth the weight and one-third the size of a comparable diesel truck engine, it approximates the performance of the bigger engine in all tests, says Swatman.

"We could make a good passenger-car gas turbine," said Swatman, "but it would be trickier to build and it would cost more. Such an engine might run 400,000 miles. This would pay off for a truck company, but what private driver today wants to pay a premium for such longevity?" In any event, George Huebner can be depended upon to go ahead improving it. "When the industry wants it," he says, "it will be ready."

The diesels. Meanwhile, hundreds of thousands of people are riding every day in cars that use a kerosene-like fuel, and many of them don't even know it. They are diesel passenger cars, most of them used for taxicabs. Popular because of the better mileage, cheaper fuel, and long life between overhauls, they have swept Europe in the last five years. The leading manufacturers are Mercedes-Benz, Austin, and F. Perkins, Ltd.

Almost all London taxicabs now use diesel engines, and they are invading New York, Detroit, Los Angeles, and other U. S. cities. Owner-drivers in London, New York, and Detroit who have switched from gasoline engines tell me that they now get twice the miles per gallon in city traffic. The motors have some disadvantages: Their pickup is sluggish, they vibrate noticeably when idling, and their exhaust is sometimes smelly, although less toxic than gasoline exhaust.

Will Tomorrow's Cars Burn Kerosene?

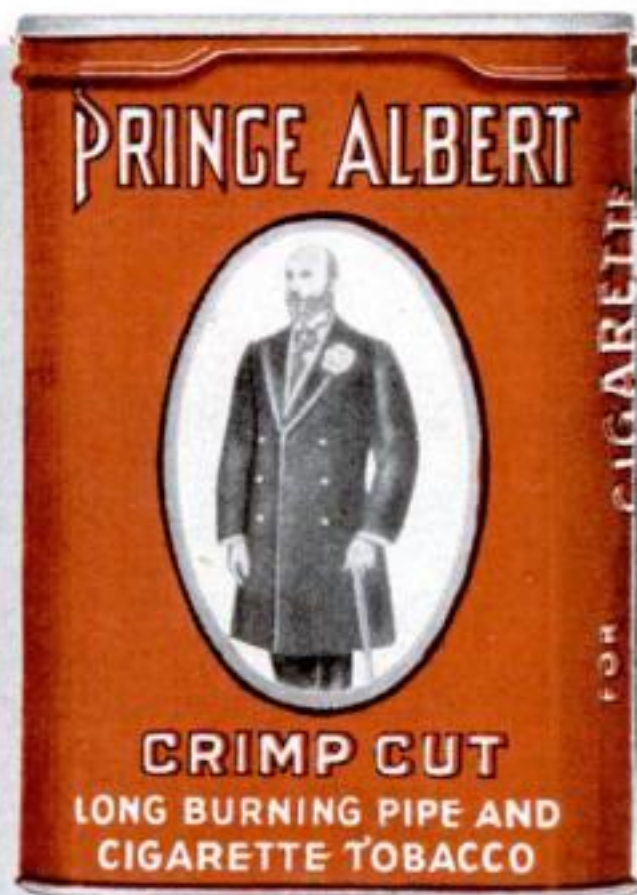
Diesel cars now on the market will not go faster than 60 miles per hour. But several firms are working on automotive diesels with higher r.p.m., which will boost acceleration; and they are planning ways to dampen the vibration.

It is entirely likely that one or more of these cheap-fuel engines will soon become too common on our highways to arouse comment. Taxicabs, light delivery trucks, and light farm and military vehicles may be the first to use them. Whether the American motorist will

burn kerosene-like fuel will be decided by Detroit, and by the driver himself.

As this article went to press, Chrysler was planning a 35-day road test of two gas-turbine cars. The first will make a fast trip from New York to Los Angeles. There it will meet the second car. The two cars will then make a leisurely trip to the East Coast covering eight cities. From these tests, Chrysler will make a final evaluation of the car's suitability for production and its public acceptance, says Mr. Huebner. ■ ■

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62-Ton Plane Stops on a Dime

[Continued from page 93]

That worked all right, too, except that boundary-layer separation kept occurring just back of the leading edge of the wing, without warning. The wing "stalled." The plane dropped.

Finally, the designers found an answer to that, too. They simply contrived more lift by lowering the big flaps on the trailing edge of the wing until they hung straight down like barn doors. The propeller slipstream, hitting them, made them act like balloon appendages to the wing.

Bossing the air. There are two ways of extending nonturbulent flow. One is by sucking air off the area where the layer begins burbling. This reestablishes a smooth flow. Sucking has its disadvantages. Any protrusion near the holes, for instance, disturbs the air flow and reduces the system's efficiency.

The other method is pumping air through the holes, from inside out, literally carrying away the burbling boundary layer. The blown air becomes a fresh boundary layer.

Lockheed's experimental plane differs

from other C-130s in four principal ways:

- It has two extra, propellerless turbine engines, hung in pods from the wing tips. These engines run compressors, which produce a total of 50 lb. of air per second under a pressure of 57 p.s.i.

- It has a duct-and-nozzle system for distributing that high-speed air to the leading edges of flaps, ailerons, elevators, and rudder. The ducts look like black furnace pipes. The nozzles, or vents, are continuous, narrow slots in trailing edges ahead of the various controls.

- Its rudder has 40 percent more chord (extends farther back) than any other C-130B's rudder.

- Its flaps can be deflected 90 degrees instead of the usual 36.

Handkerchief runway. Using its "blown" flaps and deflected slipstream, the BLC-130 takes off in 500 feet at 65 knots. The usual C-130B gets away in 1,500 feet at 85 knots. The craft with the BLC lands in 500 feet at 70 knots. The C130B comes in at 110 knots and uses up 1,800 feet in its ground roll.

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62-Ton Plane Stops on a Dime

military services would like very much to be able to land and supply troops in forward areas with a minimum of airfield preparation. If they could set down a substantial load anywhere they could find 500 feet of level, firm sod, and fly off again from the same small space, they'd have an enormous advantage. It would be the next best thing to being able to take off or land vertically.

Commercial airlines, too, would like a plane of substantial capacity that could get in and out of little airports, and thus increase the scope and volume of their business.

Since planes that can take off and land vertically are highly complicated, difficult to control, still in the experimental stage, and full of bugs, it was logical to try converting a well-proven cargo plane into a STOL aircraft.

Drop platform. In flight, of course, boundary-layer control is of no use unless the plane is to make an air drop of supplies or troops. In this situation, the BLC-130 behaves almost as if an invisible giant hand were holding it back. It slows down to 70 knots, a speed at which helicopters can easily pass it. This remarkably slow pace enables it to provide a superior platform for accurate drops. At that speed, with its great bulk, it appears to drift along like a blimp.

Lockheed's BLC-130 has no serious rival in this country, say scientists at Ames Research Center. It does, however, have a promising competitor in France, the much smaller Breguet 941. This is a 22-ton, four-engine turboprop job.

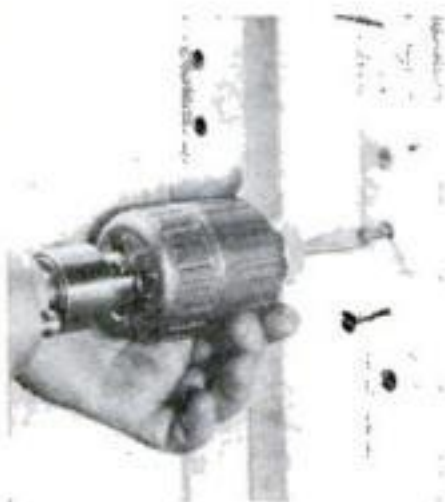
The Breguet's props are counter-rotating. That makes for greater control stability than the BLC-130's, which all turn in one direction. And the Breguet's propellers are mechanically interconnected. If one engine dies, the three other engines will turn its prop.

The British have in mind a version of Lockheed's BLC-130 that would be a decided improvement over the American testbed. It would utilize four Rolls-Royce propjet engines to supply power for both propellers and compressors, and dispense with the pod engines. This, the Lockheed people declare, would enable the craft to make even more spectacularly short take-offs and landings, and go faster in straight-and-level flight. ■ ■

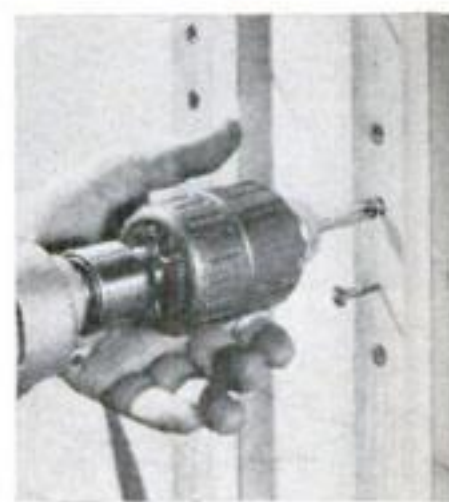
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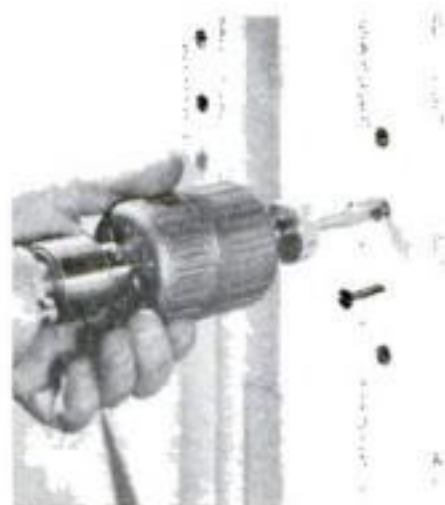


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Should You Buy an FM Car Radio?

[Continued from page 144]

road, you're ready to evaluate FM's remaining major aspect—the availability of programs and their content.

Unlike service in the standard broadcast band, FM does not saturate the country. There are no FM equivalents of AM's clear-channel stations that fill every corner of the country with adequate signals. FM sends out a line-of-sight wave that won't curve over the horizon. So don't count on steady FM listening during long trips.

While checking out a unit on a drive between New York City and Albany, a 140-mile trip, solid reception *was* possible through retuning. But this is an isolated example—a populated stretch with several stations along the way.

Looking ahead. FM programming as it exists today is well-known; plenty of good music with the accent on sound quality. And the outlook is bright.

The FCC, regulator of the air waves, is casting an official eye on "simulcasting." This is a practice of many stations—transmitting identical programs over their AM and FM outlets. It represents a considerable waste of precious radio frequencies. Recently, FCC took the first steps toward a possible change in the situation. The agency is inviting comments on whether such duplication should be ended. We can't predict what the nature of any new programs might be, but the FM fan could reap a handsome benefit.

The man who doesn't need it. You probably will not want car FM if you do most of your driving in a rural area barren of FM stations. Deep-fringe areas, too, are liable to prove disappointing. Mobile conditions are tough on weak stations. Another disqualifying factor is programming. If your tastes don't extend to music written more than 10 or 15 years ago, an investment in this equipment adds up to an expensive novelty—unless you're willing to pay for the improved audio quality of simulcast AM.

If you don't cancel out because of reasons given above, you're an excellent candidate for car FM. With at least one or two stations in your area, there's a potential wealth of fine orchestral and vocal music. And, if you shoot the works, you'll get a striking improvement over the sound of AM radio. ■ ■

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Color TV—Is It Worth the Money?

[Continued from page 131]

in Chicago, KHJ-TV in Los Angeles, KTVU in San Francisco, and some CBS and ABC affiliated stations broadcast color programs more or less regularly.

Control trouble. Baby sitters can play havoc with the color set, we found. We left one in charge of the brood one night and when my wife turned on the set the next day she ran for the phone. The picture was dark, she reported, with people who had bloated lavender faces which she could see only momentarily because the picture was tearing sideways. I told her to relax until I could take care of it.

When I got home, I discovered that the baby sitter had done just about every wrong thing with the controls. The first thing I did was adjust the conventional horizontal-hold and contrast and brightness controls to get a stable picture. After that, it was a cinch to turn the two color controls to zero in on John Wayne's baby-blue eyes and ruddy complexion. Seems to me that was the finest Western I ever watched.

Leave the back alone. To a confirmed do-it-yourselfers, those out-of-reach servicing adjustments on the back of the set are a temptation. They carry such exotic names as "Red SCR," "Kine Bias," and "Green Drive." Beware—they are not for meddlers. For unlike the front-of-set color controls, which have a wide latitude and are easily set to rights, the controls on the back can really mess up the color.

During a break in a color Western, "Bonanza," last week, my skeptical friend Willie, whose belief that color TV is a waste of money doesn't stand in the way of his enjoying mine, asked me if I had heard about the latest breakthrough on color-TV sets: a new, thinner color tube that will reduce the depth of the receiver.

Well, such talk had kept me from buying a color set for three years—and no big change had come along. I figure I'll be enjoying my color set (and so will Willie) for at least another two years before any radical change lowers the price. By that time I will have made up in enjoyment whatever I could have saved in cost. That sounds like a pretty good gamble to me. ■ ■

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Hi-Fi Stereo Bench

[Continued from page 134]

specs can be substituted, but the results may not be as good. And you can't improve much on the price: Total cost for our six speakers was under \$40.

Before mounting the speakers, check the phasing and mark the polarity of the terminals. The easiest way is with a flashlight cell. Solder 30" lengths of wire to each woofer terminal, 12" lengths to both midrange and tweeter. Hold the free end of one wire from each pair on the bottom (negative) of the cell and touch the other wire to the top terminal.

The speaker cone should move out (away from the magnet structure) at the moment of contact. If it doesn't, interchange the wires to the cell. Make a plus mark by the speaker terminal connected to the positive pole of the cell. Repeat this procedure for each of the six speakers. With the tweeters, it may be necessary to rest your fingers lightly on the cone to tell which way it moves.

Keep track of wires. Use four 1½"-10, flathead bolts with lock washers and nuts to mount each speaker. Don't overtighten. Before wrapping each woofer with a 12"-wide strip of fiber-glass, be sure you'll be able to identify the wire going to the plus terminal of the speaker.

Wire one of the large inductors (L1) in series with the plus lead to each woofer. Mount them inside the enclosure at least 6" apart. *Do not use iron or steel hardware for mounting.* Brass is okay.

There is nothing acoustically critical about the construction of the satellites as long as they are made no smaller than shown. The oblong cut-out for the midrange was found to spread the sound, and suppress any tendency to midrange peaks, better than the usual circular opening.

Leave plenty of slack in the leads connecting the satellites to the amplifier input terminals on the woofer box. Ordinary lamp cord is fine here.

For best results, place the woofer so that it faces the longest dimension of your listening room. Flexibility in placing the satellites is the big virtue of this system. Once you slip them from their niche, they can be moved as far as their extension wires permit. You'll want to experiment to find the best arrangement for your room and taste. ■ ■

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Building an Electronic Phone Secretary

[Continued from page 150]

can get up to about 30 on a half-hour reel.

Checking the operation. Hook up the recorder and control box as shown in the pictorial diagram. You can omit the phone connections for the moment. The sensitivity control (R6) will be used to simulate the telephone ringing. Start with it turned fully counterclockwise (off). Switch on the control box. Allow the tubes to warm up for about a minute. Turn knob on R6 slowly clockwise. At some point the recorder should start. When it does, return R6 to the off position. After a few seconds' delay, the phone-button arm should snap up and the tape recorder should start playing back your voice.

After the announcement, the first strip of silvered tape reaches the tape switch, and causes SOL-2 to pull in and flip the machine to record. The next silvered strip appears in 30 seconds, releases SOL-2, drops the phone-button arm and turns off the recorder. This marks the end of the first message cycle.

Setting up the answering service. After you're satisfied that the control box is working properly, finish the hookup as shown in the pictorial diagram. Have someone call your number. While the phone is ringing, advance R6 in small steps until the unit is triggered. If it does not go back to stand-by after the first message, you have the sensitivity control set too high. Back off a bit and try again. When you find the correct setting, mark it on the panel.

Ask your caller to compare the volume of your live and recorded voice. Adjust the volume control on the recorder until they both sound the same.

Message playback. A glance at the tape reels will tell whether your automatic secretary has answered any calls while you were away. If the tape has advanced past the "start" mark, here's what to do: Unthread the tape from the tape switch, remove the machine's power plug from the control-box receptacle and plug it into a wall outlet. Rewind the tape and play it back as you would any other tape. It is important that the tape always be removed from the tape switch before rewinding or playback, or the silver paint will wear away fast. ■ ■

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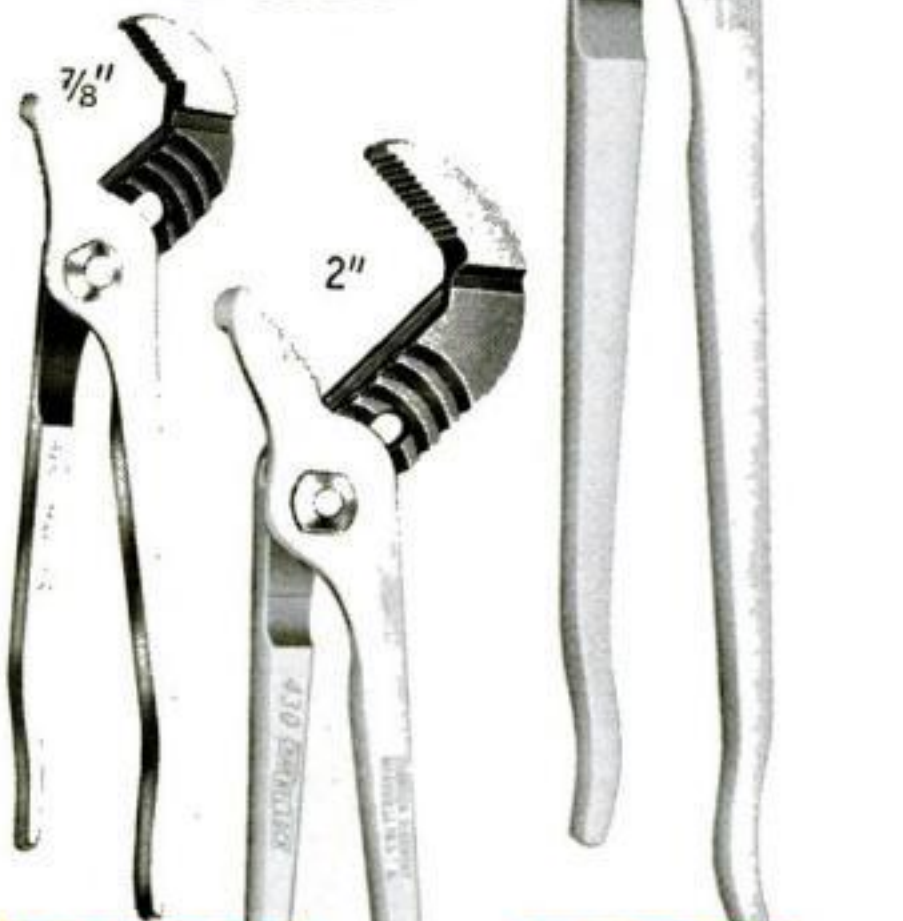


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Suddenly Everybody's Soldering

[Continued from page 128]

of radio kits. But those early models were a far cry from today's kits. About all you got was a box of parts, a schematic diagram, and the maker's best wishes.

Another pioneer in the business—now a familiar name in hi-fi kits—had an unexpected start. Back in 1927, it was the Heath Airplane Company, and it didn't get into electronic kits until 1946. The company, which by that time was building aircraft radio equipment, bought up several warehouses of surplus electronic parts with the idea of manufacturing radio test equipment.

The firm designed an oscilloscope, but found itself short of factory space in which to set up a production line. Cliff Edwards, now vice president, suggested that they sell the parts in kit form, thus eliminating the need for assembly-line space. So successful was this scheme that a year later the company sold its aircraft division to devote full time to the electronic-kit business.

Came the hi-fi boom. For the first few years after the war, kit manufacturers for the most part turned out only test instruments—voltmeters, signal generators, oscilloscopes, and the like. Radio and TV repairmen bought them because they were cheaper than ready-made models. Then, in the early 1950s, came the beginning of the hi-fi boom, and kit makers really blasted into orbit.

Hi-fi fans wanted top-notch equipment, but a top-rated ready-made unit could cost as much as several hundred dollars. Kit makers were quick to see that they could offer equipment second to none in quality, and do it at a reasonable price. Hi-fi kits caught on fast. H. H. Scott, Inc., and Harman-Kardon, for example, two leaders in high fidelity, made their finest equipment for do-it-yourselfers.

By the mid 1950s, there was only one piece of equipment—the FM tuner—not generally available in kit form. The reason: Tuning the "front end"—the first several amplifying stages—was tough. Anybody could build a tuner, but adjusting it for perfect operation required expensive equipment and technical know-how.

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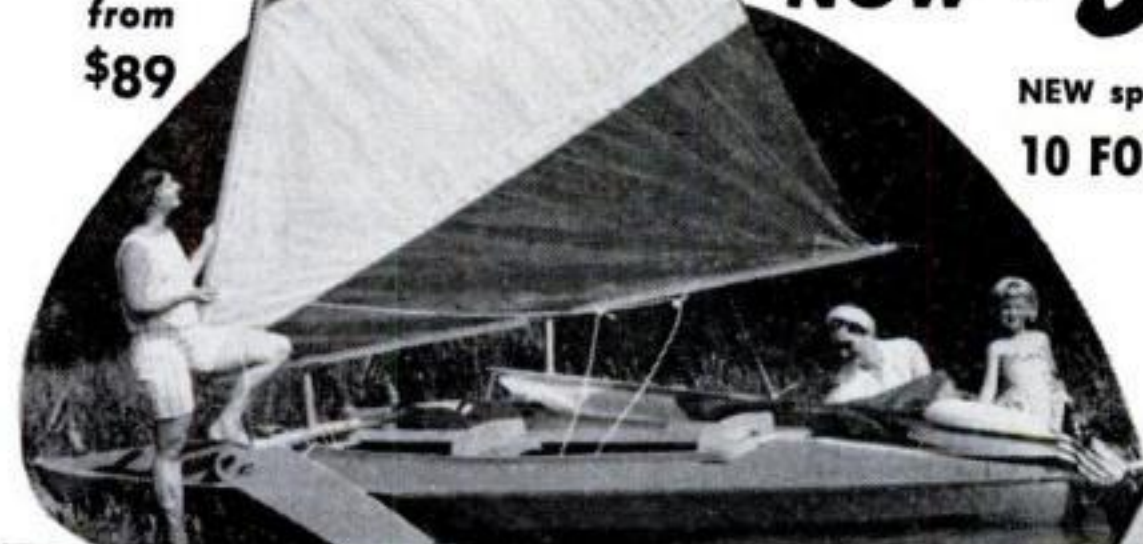
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Suddenly Everybody's Soldering

the problem. He built and aligned the front end in the factory, left everything else for the home builder to put together. Now, every major manufacturer makes easy-to-build tuners, using a similar technique.

Kits for everything. Kit makers have plunged into new fields until today virtually any kind of electronic equipment is available in kit form. Want a radio-controlled garage-door opener? Heath makes one [see page 136]. The same company will also sell you kits for a marine depth finder, an ignition analyzer, a darkroom timer, and dozens of other items. Radio Shack in Boston makes an electronic remote-reading thermometer. Allied markets a burglar alarm and a transistorized tachometer.

And they're all still looking for new ideas. Heath, with a line of about 375 assemble-it-yourself items now, brings out 60 to 80 new models a year. Where do new ideas come from? Some, like the Citizens Band equipment now being manufactured by all companies, come about naturally. The FCC authorizes a new service, and kit makers work overtime to get equipment on the market. The same thing happened recently when FM multiplex was authorized.

Other suggestions come in through the mail. Heath's IM-20 Handy Lab, which has crammed into one small case a voltmeter, signal generator, continuity checker, resistor and capacitor substitution boxes, and a code-practice oscillator, was suggested by a kit builder. Not every mail suggestion, of course, is so practical. One man, for example, recently suggested that the company produce a receiver tunable to five specific frequencies, which he listed. Those frequencies, he explained, were the channels used for communications between flying saucers and their mother ship.

The uranium thud. Even the new ideas that get into production aren't always winners. During the uranium boom of the mid-1950s, everyone who could manage it went romping through the Western mountains with a Geiger counter in search of instant wealth. Heath put its engineers to work, and within a few months shining new Geiger-counter kits were rolling off the production line—just in time for the end of the uranium boom.

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ELECTRIC STORAGE BATTERY WINCH

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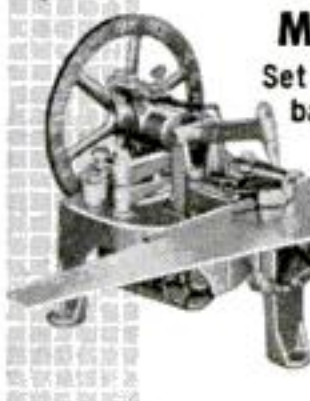
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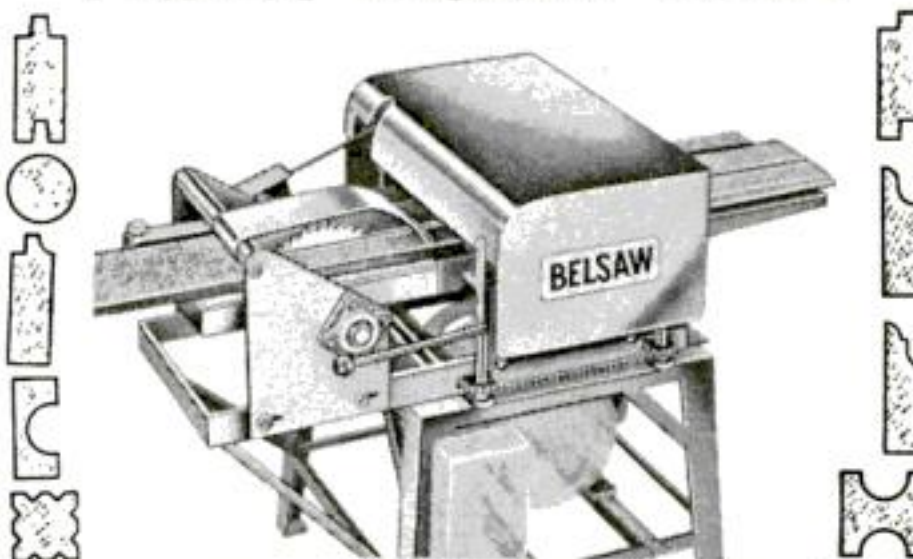
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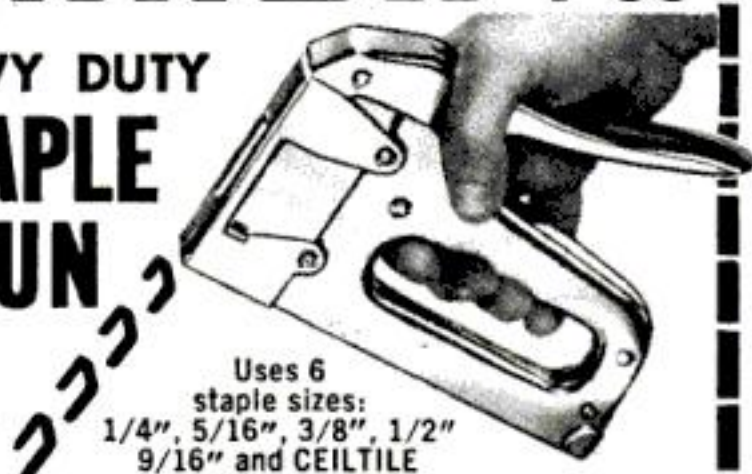
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Suddenly Everybody's Soldering

Most items, however, are more successful. Hottest new kits today are Citizens Band equipment and electronic educational kits. Manufacturers are particularly enthusiastic about the educational units: They teach youngsters the basic principles of electronics, and at the same time get tomorrow's builders in the kit habit.

Sold on kits? Want to try one? Besides the kit, you need about \$10 worth of tools. You can get started with a soldering iron, one small and one medium screwdriver, one pair of needle-nose pliers, and one pair of diagonal side cutters. You may want to augment this later, but these are the essentials. Now you're ready to begin. Follow these simple rules and you'll have no trouble:

1. Find a quiet place to spread out, preferably one where you can leave everything as is until you finish. (That could be anywhere from several hours for a bedside radio to several months for an electronic organ.)

2. Make up your mind to follow directions to the letter, even if you don't see the reason for everything at first.

3. Read the instruction book from cover to cover before you start work.

4. Check all parts against the parts list. Identify each one from its picture unless you're already on a first-name basis with such diverse items as trimmers, IF cans, and speed nuts.

5. If you've never soldered before, practice a little before you start your kit. Soldering isn't difficult, but it must be done properly. All instruction books give complete details. Fifteen minutes should make you an expert.

6. Dive in.

One final tip: Don't get carried away when you're planning your project. It's easy to do, building kits. One youngster, for example, had become fascinated watching the little green line dance across the face of an oscilloscope at a local TV serviceman's shop. He saved his money, bought a kit oscilloscope from EICO, and built it. It worked perfectly. But still there was a problem. His letter to the factory was a tough one to answer. "I have built my oscilloscope and it works fine," he wrote. "Could you please suggest something I can do with it?"

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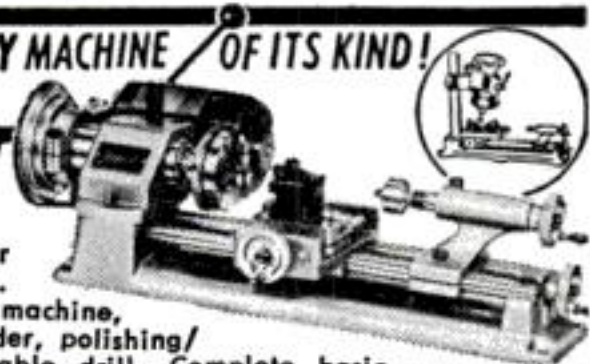
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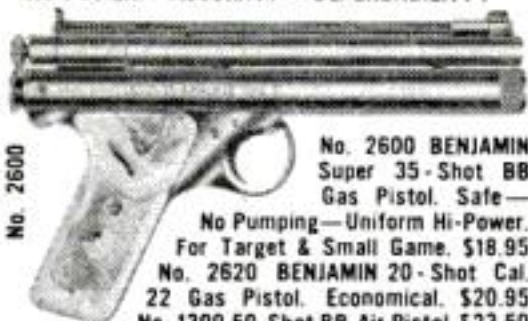
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Southern Customers Order from Dept. B-262, Box 65, Sarasota, Florida



Home Shop News Report

[Continued from page 186]

with no trouble. In one-minute tests on pine, No. 6/0 closed-coat actually produced a smoother finish than No. 6/0 open, with only slightly more clogging.

Both Wellers will stall if you bear down too hard. The trick is to press lightly, lifting the plate every few seconds to let the dust shake free. The short stroke tends to keep the dust neatly on the work instead of swirling it off in a cloud. And the lack of heavy vibration lets you sand tirelessly for hours.

The entire housing, even to the sanding plate, is made of shockproof plastic. The older model wasn't recommended for wet sanding; the new one is. With No. 400 paper used wet, it fine-finished a varnished 4"-by-5" block in 20 seconds. Fitted with a short-nap cloth, such as for shining shoes, it will also polish metals.

That new handle: A mixed blessing?

Those who have come to like the sure, fist-grip control of the old Weller may wonder: Why the handle? It does make control less intimate and adds height—the old pee-wee Weller could sneak into places the new one can't. But it's perhaps the price of progress since the new Weller, being heftier, would be awkward to grasp by the housing alone.

One nice touch is a bright red auxiliary knob that can be switched to either side for two-hand use by righties or lefties. Another: Each Weller comes packed with a selection of aluminum oxide papers from coarse to fine, pre-cut into handy strips. A coarse (1/0) strip is already on the sander, ready to go to work. Our opinion, in short: The old Weller was good; the new one is great.

Looking for electronic kits? A new line of hi-fi and test equipment is being offered to the public for the first time by National Radio Institute, a correspondence school long famous for its student kits. The new kits will be sold under the name Conar Instruments, 3939 Wisconsin Ave., Washington 16, D. C. One of the first will be an unusual home tester kit that measures volts, amps, and ohms for trouble-shooting house wiring and appliances. Price: \$20. (For news of other electronic kits, see page 124.) ■■

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WINEGARD
**TENNA-
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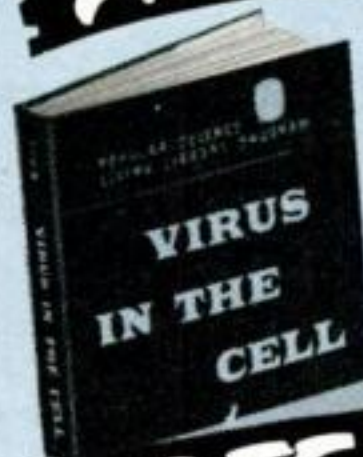
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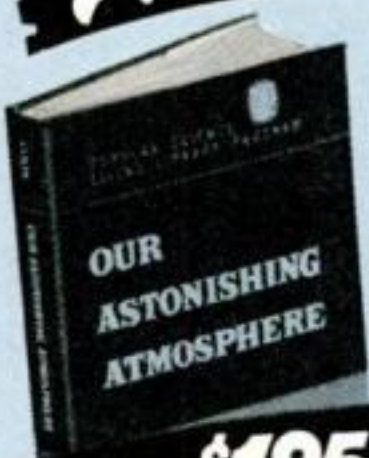
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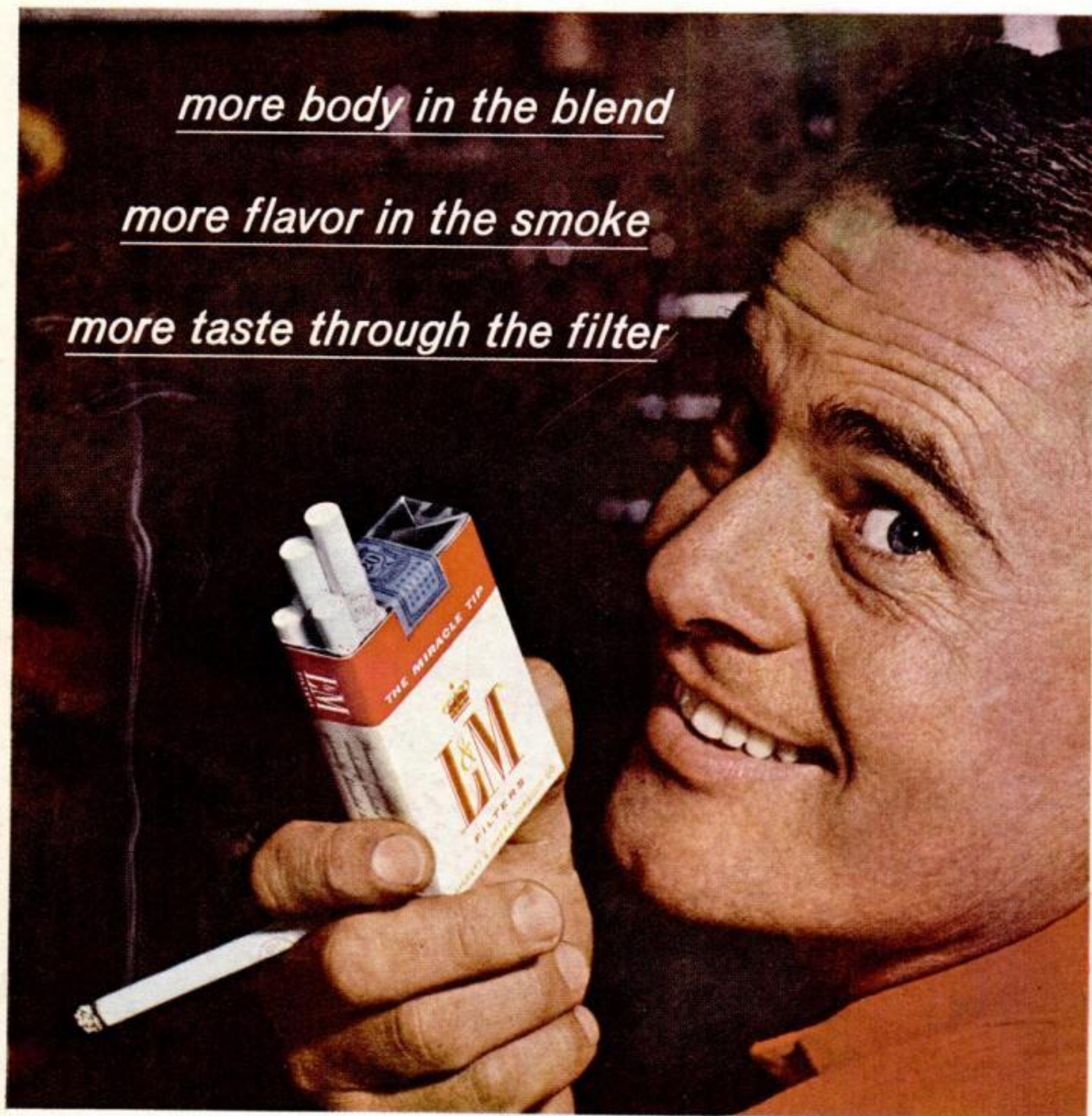
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